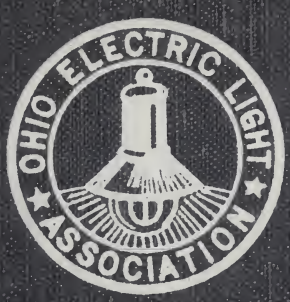
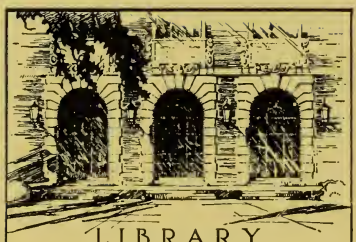


PROCEEDINGS OF THE
OHIO ELECTRIC LIGHT ASSOCIATION

1919



LIBRARY
OF THE
UNIVERSITY
OF ILLINOIS

621.31106
OH
1919

PROCEEDINGS

Twenty-Fifth Annual
(Silver Anniversary) Convention

OHIO ELECTRIC LIGHT ASSOCIATION

Hotel Breakers, Cedar Point, Ohio
July 15, 16, 17 and 18

1919

Published by the Secretary

Douglas A. Brown, Official Reporter
Cincinnati, Ohio

THE KEMBLE PRESS.
FOURTH AND BROADWAY,
GREENVILLE, OHIO.

621.31106
OH
1919

OFFICERS AND STANDING COMMITTEES FOR 1919-1920

C. H. Howell, President ..... Coshocton, Ohio
D. L. Gaskill, Secretary-Treasurer ..... Greenville, Ohio
F. H. Golding, Vice-President ..... Canton, Ohio

Executive

E. L. Franklin ..... Warren
D. J. Hard ..... Wooster
Robert Lindsay ..... Cleveland
O. H. Hutchings ..... Dayton
W. A. Wolls ..... Columbus

Advisory

W. W. Freeman ..... Cincinnati
E. P. Matthews ..... Dayton
J. C. Martin ..... Columbus

Finance

Mason H. Lytle ..... Piqua
Norman McD Crawford ..... Columbus
J. T. Kermode ..... Cleveland

Station Operating

Henry B. Dates ..... Cleveland
Wm. Long ..... Toledo
R. G. Sloat ..... Sandusky
H. W. Bromley ..... Youngstown
W. H. Aldrich ..... Cleveland
J. J. Dolan ..... Coshocton
C. H. Speihler ..... Dayton
C. W. De Forest ..... Cincinnati
S. M. Rust ..... Greenville

Illumination

G. S. Merrill ..... Cleveland
K. Fitzpatrick, Jr. ..... Dayton
F. A. Grohsmeyer ..... Akron

New Business Co-Operations

Commercial Lighting and Merchandising Section

C. G. Eichelberger ..... Cincinnati
Mason H. Lytle ..... Piqua
Bruce Masters ..... Columbus
John Slade ..... Toledo

Industrial Power and Heating Section

J. C. Matthieu ..... Dayton
H. W. Wood ..... Youngstown
M. W. Arthur ..... Akron
A. C. Shepherd ..... Cleveland
Emmet Schaub ..... Canton

Transmission and Distribution

W. E. Beatty ..... Cincinnati
M. E. Grah ..... Toledo
C. A. Harrington ..... Youngstown
J. B. Johnson ..... Elyria
R. R. Krammes ..... Newark
C. N. Rakestraw ..... Cleveland
A. M. Wilson ..... Cincinnati

Meters

J. L. Wright ..... Toledo
S. C. Henton ..... Akron
C. M. Goldberg ..... Cincinnati
H. E. White ..... Youngstown

PRESIDENTS SINCE ORGANIZATION

Since the organization of the Ohio Electric Light Association the following gentlemen have filled the office of President:

1895-1896—A. W. Field.....Columbus, Ohio
1896-1897—John I. Beggs.....Cincinnati, Ohio
1897-1898—H. K. Wood.....Piqua, Ohio
1898-1899—Emil G. Schmidt.....Sandusky, Ohio
1899-1900—D. L. Gaskill.....Greenville, Ohio
1900-1901—Ernest J. Bechtel.....Toledo, Ohio
1901-1902—W. F. White.....Cincinnati, Ohio
1902-1903—A. W. Field.....Columbus, Ohio
1903-1904—J. H. Perkins.....Youngstown, Ohio
1904-1905—M. E. Turner.....Cleveland, Ohio
1905-1906—S. M. Rust (resigned).....Piqua, Ohio
—F. E. Valentine (resigned).....Piqua, Ohio
—W. E. Russell (acting).....Massillon, Ohio
1906-1907—W. P. Engle.....Defiance, Ohio
1907-1908—F. M. Tait.....Dayton, Ohio
1908-1909—C. R. McKay.....Toledo, Ohio
1909-1910—J. C. Rothery.....East Liverpool, Ohio
1910-1911—E. H. Beil.....Youngstown, Ohio
1911-1912—W. C. Anderson.....Canton, Ohio
1912-1913—J. C. Martin.....Wilmington, Ohio
1913-1914—J. C. Martin.....Wilmington, Ohio
1914-1915—C. V. Hard.....Wooster, Ohio
1915-1916—W. J. Rose.....Alliance, Ohio
1916-1917—E. A. Bechstein.....Sandusky, Ohio
1917-1918—O. H. Hutchings.....Dayton, Ohio
1918-1919—I. L. Oppenheimer.....Pomeroy, Ohio
1919-1920—C. H. Howell.....Coshocton, Ohio

DATES AND PLACES OF CONVENTIONS

Since the organization of the Association its meetings have been held in the following places:

Piqua	October 8-9, 1895
Springfield	October 13-14, 1896
Cincinnati	October 12-13, 1897
Sandusky	August 18-19, 1898
Cleveland	August 10-11-12, 1899
Toledo	August 10-11-12 1900
Put-in-Bay (Hotel Victory)	August 20-21-22, 1901
Columbus	October 14-15-16, 1902
Columbus	October 13-14-15, 1903
Sandusky	August 16-17-18, 1904
Put-in-Bay (Hotel Victory)	August 16-17-18, 1905
Put-in-Bay (Hotel Victory)	August 21-22-23, 1906
Toledo	August 20-21-22, 1907
Put-in-Bay (Hotel Victory)	August 25-26-27, 1908
Toledo	July 13-14-15, 1909
Cedar Point	July 26-27-28, 1910
Cedar Point	July 25-26-27, 1911
Cedar Point	July 16-17-18-19, 1912
Cedar Point	July 15-16-17-18, 1913
Cedar Point	July 21-22-23-24, 1914
Cedar Point	July 20-21-22-23, 1915
Cedar Point	July 18-19-20-21, 1916
Cedar Point	July 10-11-12, 1918
Cedar Point	July 16-17-18-19, 1919

LIST OF ATTENDANTS AT TWENTY-FIFTH ANNUAL CONVENTION.

ACTIVE.

M. W. Arthur .....Northern Ohio Trac. Co., Akron, Ohio
W. H. Aldrich.....Cleveland Elec. Ill. Co., Cleveland
Robt. S. Ashe .....Liberty Lt. & Pr. Co., Richmond, Ind.
Lewis Bond Ashe .....Richmond, Ind.
E. H. Billman .....Alliance Gas & Power Co., Alliance
S. L. Bennett .....The Ohio Utilities Co., Hillsboro
Irvin Bringartner .....Sandusky Gas & Elec. Co., Sandusky
L. E. Brown.....Springfield Lt. Ht. & Pr. Co., Springfield
H. W. Bromley ....Mahoning & Shenango Ry. & Lt. Co., Youngstown
J. P. Bromley..Mahoning & Shenango Ry. & Lt. Co., Youngstown
G. S. Bromley....Mahoning & Shenango Ry. & Lt. Co., Youngstown
H. G. Bonner .....Alliance Gas & Pr. Co., Alliance
J. P. Boyd.....Central Power Co., Fremont
N. M. Baxter.....Lorain County Elec. Co., Elyria
L. A. Bryant.....Dayton Pr. & Lt. Co., Dayton
E. H. Beil.....Mahoning & Shenango Ry. & Light Co., Youngstown
A. H. Bryant.....Cleveland Elec. Illuminating Co., Cleveland
W. E. Beatty.....Union Gas & Elec. Co., Cincinnati
Douglas A. Brown.....Official Reporter, Cincinnati
Ralph D. Cole.....Findlay, Ohio
Sherman Congdon, Jr.....Central Power Co., Newark
R. W. Curran.....Trumbull Public Service Co., Warren
Jas. J. Cooney.....Toledo Rys. & Light Co., Toledo
F. C. Caldwell.....O. S. U., Columbus
Z. T. Dorman.....Greenville E. L. & P. Co., Greenville
C. W. De Forest.....Union Gas & Elec. Co., Cincinnati
E. D. Chapman.....Central Power Co., Tiffin
C. I. Doudna.....Dayton Power & Light Co., Dayton
Wm. A. Durgin.....Commonwealth Edison Co., Chicago
C. G. Eichelberger.....Union Gas & Elec. Co., Cincinnati

Harry Engle.....Mahoning & Shenango Ry. & Lt. Co., Youngstown
K. Fitzpatrick, Jr. .....Dayton Power & Light Co., Dayton
W. T. Fitzgerald .....Greenville Elec. L. &. P. Co., Greenville
H. I. Fox.....Dayton Power & Light Co., Wilmington
M. E. Grah.....Toledo Rys. & Light Co., Toledo
J. L. Gaston.....Union Gas & Elec. Co., Cincinnati
Charles M. Golberg.....Union Gas & Elec. Co., Cincinnati
R. D. Gillespie.....Dayton Pr. & Light Co., Dayton
F. H. Golding.....Central Power Co., Canton
Harold C. Griffin.....Acme Power Co., Toledo
Farrin T. Griest.....Dayton Power & Light Co., Dayton
F. G. R. Gordon.....Haverhill, Mass., N. E. L. A.
D. L. Gaskill.....Greenville E. L. & P. Co., Greenville
A. M. Grall.....Ashland Gas & Elec. Co., Ashland
Chas. P. Garman.....Dayton Pr. & Light Co., Dayton
O. H. Hutchings.....Dayton Pr. & Light Co., Dayton
C. C. Henderson.....Toledo Rys. & Light Co., Toledo
H. A. Holmes.....Mahoning & Shenango Ry. & Lt. Co., Youngstown
Harry W. Hough.....Cleveland Elec. Illuminating Co., Cleveland
H. F. Heyman.....Alliance Gas & Pr. Co., Alliance
R. R. Herkins.....Dayton Pr. & Light Co., Dayton
Jos. B. Holturn.....Union Gas & Elec. Co., Cincinnati
C. H. Howell.....Ohio Service Co., Coshocton
E. H. Heathman.....Dayton Power & Light Co., Xenia
Dudley J. Hard .....Cleveland Light & Power Co., Cleveland
S. F. Hetrick.....Dayton Power & Light Co., Piqua
J. K. Himes.....Dayton Power & Light Co., Dayton
C. C. Irwin.....Union Gas & Elec. Co., Cincinnati
J. B. Johnson.....Lorain County Elec. Co., Elyria
Frank Jones.....Dayton Power & Light Co., Dayton
C. H. Kramer.....Union Gas & Elec. Co., Cincinnati
J. T. Kermode.....Cleveland Elc. Illuminating Co., Cleveland
Karl A. Katzenberger....Brookville & Lewisburg Ltg. Co., Lewisburg
W. E. Ives.....Henry L. Doherty, Alliance
Robt. Lindsay.....Cleveland Elec. Illuminating Co., Cleveland
James F. Loftus.....The Central Power Co., Tiffin
C. E. Lewis.....Toledo Rys. & Light Co., Toledo
Mason H. Lytle.....Dayton Power & Light Co., Piqua

Fred O. Lewis.....Dayton Power & Light Co., Dayton
Wm. Long.....Toledo Rys. & Light Co., Toledo
T. B. McMillan.....Trumbull Public Service Co., Warren
Wm. McClellan.....Cleveland Elec. Illuminating Co., Cleveland
C. A. Mullen.....Ohio Service Co., Coshocton
E. M. McClintock.....The Ohio State Power Co., Fremont
Geo. M. Miller.....Louisville Gas & Elec. Co., Louisville, Ky.
J. C. Matthieu.....Dayton Power & Light Co., Dayton
Wm. J. Marshall.....Trumbull Public Service Co., Warren
G. E. Miller.....Cleveland Elec. Illuminating Co., Cleveland
J. C. Martin.....The Ohio Utilities Co., Columbus
I. L. Oppenheimer.....Pomeroy & Middleport Elec. Co., Pomeroy
Wm. J. Oppenheimer.....Pomeroy
A. J. Patrick.....Dayton Pr. & Light Co., Dayton
L. C. Peterman.....The Ohio Utilities Co., Columbus
W. Porter Jones.....Salem Lighting Co., Salem
George W. Rauch.....Massillon Gas & Elec Co., Massillon
E. T. Schneider....Cleveland Southwestern & Cols. Ry. Co., Ironton
W. E. Salber.....Ironton Electric Co., Ironton
H. C. Stephens.....Northern Ohio Trac. & Light Co., Akron
A. C. Shepherd.....Cleveland Electric Illuminating Co., Cleveland
G. B. Schneeberger.....Cleveland Elec. Illuminating Co., Cleveland
H. J. Schnerberg.....Union Gas & Elec. Co., Cincinnati
Harry Schott.....Harrison Elec. & Water Co., Harrison
R. G. Sloat.....Sandusky Gas & Elec. Co., Sandusky
T. H. Slade.....Toledo Railways & Light Co., Toledo
Jas. L. Stone.....Richland Public Service Co., Mansfield
C. H. Speiler.....Dayton Power & Light Co., Dayton
B. C. Taylor.....Dayton Power & Light Co., Dayton
E. T. Wagenhals.....Central Power Co., Newark
W. P. Whittington.....Springfield Light Ht. & Pr. Co., Springfield
A. M. Wilson.....University of Cincinnati
J. L. Wright.....Toledo Railways & Light Co., Toledo
W. B. Wilkinson.....Center Power Co., Newark
Chas. P. Wahn.....Ohio Utilities Co., Circleville
H. E.White.....Mahoning & Shenango Ry. & Lt. Co., Youngstown
Max Wilke.....Ohio River Power Co., Steubenville

Joseph B. Wilson.....Massillon Gas & Elec. Co., Massillon
H. S. Williams.....Cleveland Elec. Illuminating Co., Cleveland
W. A. Wolls.....Columbus Rr. Light & Power Co., Columbus
H. L. Wallau.....Cleveland Elec. Illuminating Co., Cleveland
Geo. Whiteley.....Greenville Elec. Lt. & Pr. Co., Greenville
Edwin D. Wood.....Louisville Gas & Elec. Co., Louisville, Ky.
C. E. Yacoll.....Mahoning & Shenango Ry. & Light Co., Youngstown
M. G. Irvin.....Lorain County Elec. Co., Elyria
E. L. Detrick.....Lorain County Elec. Co., Elyria
L. Fred Heckler.....Lake Shore Elec. Ry. Co., Fremont
C. Everett Stine.....Lake Shore Elec. Ry. Co., Fremont
Edgar R. Mann.....Lake Shore Elec. Ry. Co., Fremont
A. M. Hildebrand.....Lake Shore Elec. Ry. Co., Fremont
Henry C. Pfister.....Lake Shore Elec. Ry. Co., Fremont, Bellevue
C. H. Hildebrand.....Lake Shore Elec. Ry. Co., Fremont, Bellevue
A. G. Moser.....Bucyrus Light & Pr. Co., Bucyrus
A. L. Thuma.....Ironton Elec. Co. Ironton
Dennis Holderly.....Ironton Elec. Co., Ironton
Earl J. Barker .....Sandusky Gas & Electric Co., Sandusky
A. L. Bitzer.....Sandusky Gas & Electric Co., Sandusky
C. L. Rohrbaugh.....Sandusky Gas & Electric Co., Sandusky
Major C. B. Wilcox.....Sandusky Gas & Electric Co., Sandusky
L. J. McCoy.....Richwood Light, Ht. & Pr. Co., Richwood
Edw. A. Schamb.....Richwood Light, Ht. & Pr. Co., Richwood
W. P. Engel.....Defiance
E. J. Burger.....Lorain Co., Electric Co., Lorain
D. W. Hennessy.....Pomeroy & Middleport Elec. Co., Pomeroy
C. W. Johnson.....Hodenpyl Hardy Co., Jackson, Michigan
G. H. Moore, Jr.....Lake Shore Elec. Ry. Co., Fremont
R. D. Bartlett.....Lake Shore Elec. Ry. Co., Fremont
R. E. Frederici.....C. S. & C. Ry. Co., Norwalk
C. G. Taylor.....C. S. & C. Ry. Co., Norwalk
R. R. Krammes.....Central Power Co., Newark
J. C. McNealey.....Ohio Utilities Co., Gallipolis
Freeman T. Eagleson.....Columbus
Matthias Turner.....Cleveland Elec. Illuminating Co., Cleveland
F. C. Morrison.....Central Power Co., Fostoria

ASSOCIATE.

John Andrews, Jr.....Westinghouse E. & M. Co.
O. R. Anthony.....Central Electric Co., Toledo
L. H. Alline.....The Packard Electric Co., Warren
O. P. Anderson.....The F. Bissell Co., Toledo
L. T. Applegate, Jr.....Post-Glover Elec. Co.
F. C. Albrecht.....Westinghouse Elec. & Mfg. Co.
S. E. Applegate.....Eureka Vacuum Cleaner Co., Detroit
G. F. Bertke.....Western Electric Co.
H. W. Beaumont.....Westinghouse E. & M. Co.
Rodrick Buch.....General Electric Co.
W. E. Bischoff.....W. N. Matthews & Bro.
S. S. Bennett.....The Post-Glover Elec. Co.
F. A. Boug.....Apex Electrical Mfg. Co.
W. F. Benedict.....Sterling Lamp Division G. E. Co.
G. F. Brackett.....The F. Bissell Co., Toledo
W. H. Bloss.....Ohio Brass Co., Mansfield
E. G. Bailey.....Bailey Meter Co., Cleveland
A. B. Beach.....Ludwig Hommell & Co.
R. W. Ten Broech.....Geo. Cutter Co., South Bend, Ind.
George Bailey.....Westinghouse Elec. & Mfg. Co.
L. A. Blackburn.....Erner Electric Co., Cleveland
L. C. Barton.....Westinghouse Elec. & Mfg. Co.
Spenser Brittain.....Pittsburgh Piping & Equipment Co.
F. K. Bybee.....The Erner & Hopkins Co.
C. R. Baehr.....Western Electric Co., Cleveland
F. W. Buck.....Hoover Suction Sweeper Co.
F. W. Campbell.....Westinghouse E. & M. Co.
A. F. Cargo .....Westinghouse E. & M. Co.
J. F. Cabot.....McGraw Hill Co., Inc., New York City
Geo. R. Canning.....A. T. & T. Co., Cleveland
F. M. Cockrell.....Electrical World, Cleveland
W. J. Crawford.....The F. Bissell Co., Toledo
W. S. Culver.....General Electric Co.
S. N. Clarkson.....Electrical World
Oscar Carman.....General Electric Co.
R. H. Carlton.....General Electric Co.

John L. Cushing.....Hurley Machine Co.
M. D. Cooper.....National Lamp Works
C. B. Covert.....General Electric Co.
L. R. Donavin.....Bissell Motor Co., Toledo
J. C. Darrow.....Packard Lamp Division
J. D. Deever.....Westinghouse Elec. & Mfg. Co.
R. J. Dibowski.....The Wadsworth Elec. Mfg. Co.
S. E. Doane.....The National Lamp Works, Cleveland
C. H. Dodt.....Western Electric Co.
Sam F. Daugherty.....Edison Lamp Works of G. E. Co.
Willis B. Dye.....Thomas J. Dye & Son, Kokomo, Ind.
L. B. Dewey.....Westinghouse Lamp Co.
J. C. Doering.....Westinghouse E. & M. Co.
W. E. East.....Bailey Meter Co.
Robert B. Ely.....Westinghouse Lamp Co
Geo. B. Edgar.....General Elec. Co.
John King Ewing, Jr.....Westinghouse Elec. & Mfg. Co.
N. R. Fisher.....The Stroud-Michael Co.
Arthur M. Mc Fayden.....Standard Underground Cable Co.
R. E. Flower.....Erner Electric Co.
S. J. Folkman.....Westinghouse Elec. & Mfg. Co.
W. E. Goodman.....Hoover Suction Sweeper Co.
Noble B. Goettel.....Edison Elec. Appliance Co.
J. H. Grant.....Wagner Elec. Mfg. Co.
R. S. Graves.....General Electric Co.
F. V. Gantt.....General Electric Co.
John J. Hickson.....The Avery-Loeb Elec. Co.
R. F. Hamilton.....The Ohio Brass Co.
W. A. Hillebrand.....The Ohio Brass Co.
A. S. Hertz.....General Electric Co.
M. J. O'Hare.....Electric Vacuum Cleaner Co.
J. C. Hart.....Railway & Industrial Engineering Co.
N. C. Husted.....Hubbard & Co.
H. G. Hall.....The Bristol Co.
F. C. Hugel.....Hurley Machine Co.
J. G. Hoffman.....The Erner & Hopkins Co.
C. J. Henry.....Edison Elec. Appliance Co.

E. H. Hesslink.....The United Electric Co.
Chester I. Hall.....General Electric Co.
C. W. Hosier.....General Electric Co.
F. J. Hunter.....Hoover Suction Sweeper Co.
W. E. Hoyt.....Hoover Suction Sweeper Co.
W. J. Hanley.....General Electric Co.
J. M. Ireland.....Westinghouse Elec. & Mfg. Co.
H. L. Jenkins.....Holoplane Glass Co.
W. P. Jend.....Westinghouse Elec. & Mfg. Co.
Arthur G. Knierim.....The F. Bissell Co.
Phil C. Keller.....Ivanhoe-Regent Works of G. E. Co.
G. J. Kuhmann.....Nagel Electric Co.
R. M. Kerschner.....Hubbard & Company
A. M. Klingman.....National Lamp Works, Cleveland
C. F. Koenig.....National Lamp Works, Cleveland
Jos. E. Kovar.....The Safety Meter Box Co.
J. N. Kuhns.....Railway & Industrial Engineering Co.
Chas. S. Kuntz.....F. D. Lawrence Elec. Co.
Ge. Knecht.....The Avery & Loeb Electric Co.
A. R. Loughborough.....Western Electric Co.
W. R. Little.....Bailey Meter Co.
H. H. Magsdick.....National Lamp Works
L. T. Milnor.....The Milnor Electric Co.
O. B. Marsh.....General Sign System Elec. Co.
W. E. McKellar.....The McKellar Elec. Co.
Al. J. Murphy.....Public Service Exhibit Bureau
J. P. McNally.....W. G. Nagel Electric Co.
G. S. Merrill.....National Lamp Works, Cleveland
A. H. Meyer.....The Bryan Marsh Division of G. E. Co.
L. G. Mockenhaupt.....Harvey Hubbell, Inc.
J. H. Merrill.....Electric Motor & Repair Co.
W. W. Mumma.....The Robbins & Meyers Co.
J. M. Michael.....The Stroud-Michael Co.
W. L. Marsh.....The Packard Electric Co.
R. C. Meller.....The F. Bissell Co.
L. U. Murray.....General Electric Co.
R. E. Moore.....Western Electric Co.
H. H. Meredith.....Westinghouse Elec. & Mfg. Co.

E. D. Monk.....General Electric Co.
C. T. McLoughlin.....General Electric Co.
R. C. Mons.....Benjamin Elec. Mfg. Co.
Walter L. Mayer.....Electric Vacuum Cleaner Co.
Richard B. McDaniel.....Westinghouse Elec. & Mfg. Co.
A. L. McLeod.....The Jeffery-DeWitt Insulator Co.
L. E. Morier.....Naugle Pole & Tie Co.
C. E. Mathes.....General Electric Co.
C. W. Murphey.....The Erner & Hopkins Co.
H. W. Mitchell.....Naugle Pole & Tie Co.
Guy D. Marmon.....The Erner & Hopkins Co.
L. B. Moore.....The Hurley Machine Co.
Geo. W. Netz.....The 1900 Washer Co.
S. C. Nodine.....Electric Vacuum Cleaner Co.
Paul B. Nau.....Westinghouse Elec. & Mfg. Co.
P. C. Neale.....National Lamp Works of G. E. Co.
William V. Orr.....The Apex Elec. Mfg. Co.
I. W. Pettengill.....Wagner Electric Mfg. Co.
Charles A. Pierson.....The Standard Elec. Stove Co.
W. F. Parker.....The Packard Electric Co.
L. L. Parkinson.....Westinghouse Lamp Co.
C. F. Powers.....Central Electric Co.
Arthur C. Prange.....F. Bissell Co.
A. V. Roche.....Maloney Electric Co.
T. W. Rolph.....Ivanhoe-Regent Works
Harry C. Rice.....National Electric Lamp Works
A. J. Reinhart.....Westinghouse Elec. & Mfg. Co.
Ralph W. Read.....Electrical World
Ralph Reston.....Republic Electric Co.
Thos. J. Ryan.....General Electric Co.
A. J. Reed.....Robbins & Meyers Co.
Chas. A. Roach.....The Wm. Hall Elec. Co.
I. L. Kentish-Rankin.....Electrical Review
P. D. Rensenhouse.....Federal Electric Co.
L. T. Rainey.....General Electric Co.
E. S. Stickle.....Stickle & Taylor Co.
W. N. Steele.....Hoover Suction Sweeper Co.

H. R. Summerhayes.....General Electric Co.
C. A. Suhr.....The Schafer-Suhr Co.
L. A. Sholes.....Air Reduction Sales Co.
W. W. Steele.....Hoover Suction Sweeper Co.
Chas. H. Steele.....The H. Poll Electric Co.
Harry Swindell.....Ivanhoe-Regent Works of G. E. Co.
G. H. Stickney.....Edison Lamp Works
H. N. St. Clair.....General Electric Co.
H. W. Shalling.....Ivanhoe-Regent Works
H. F. Saur.....Electric Storage Battery Co.
C. H. Scott.....The F. Bissell Co.
C. W. Smith.....The Stroud-Michael Co.
H. T. Spaulding.....National Lamp Works
A. G. Summerell.....National Carbon Co.
S. F. Swarr.....Westinghouse Elec. & Mfg. Co.
A. A. Schueler.....The Square D Co.
P. B. Stine.....The Erner Electric Co.
Hugh C. Stephens.....Naugle Pole & Tie Co.
Wm. H. Sinks.....Duncan Elec. Mfg. Co.
[illegible]. W. Schrantz.....Westinghouse Electric & Mfg. Co.
Edw. Stryker, Jr.....National Lamp Works
John B. Sebring.....The Ohio Brass Co.
C. E. Smock.....Eureka Vacuum Cleaner Co.
O. Terris.....The F. Bissell Co.
W. H. Thompson.....The Thompson Hayes Co.
Robert Thornton.....Eureka Vacuum Cleaner Co.
[illegible] Thompson.....The Delta Star Elec. Co.
Thos. T. Thomas.....The Hoover Suction Sweeper Co.
R. J. Valentine.....The F. Bissell Co.
E. L. VanWinkle.....The Post-Glover Elec. Co.
E. L. Wright.....General Electric Co.
Paul Wheeler.....The Link-Belt Co.
H. C. Wilson.....General Electric Co.
Macey Whitney.....The F. Bissell Co.
Geo. B. Wadsworth.....The Wadsworth Elec. Mfg. Co.
P. J. Williams.....The Post-Glover Electric Co.
L. E. Wheeler.....Westinghouse Elec. & Mfg. Co.

P. Worth.....General Electric Co.
L. G. White.....Public Utilities Commission
Vernon W. Young.....Eureka Vacuum Cleaner Co.
V. M. Yates .....Packard Lamp Div. of G. E. Co.
H. W. Young.....Delta Star. Elec Co.
J. E. Zeluff.....National Pole Co.
Martin L. Zahm.....The Republic Electric Co.
Leon C. Zimmerman.....The United Electric Co.

PROCEEDINGS

Tweuty-Fifth Annual Convention Ohio Electric Light Association.

The Twenty-fifth Annual Convention (Silver Anniversary) of the Ohio Electric Light Association was held at the Breakers Hotel, Cedar Point on Lake Erie, Ohio, July 15, 16, 17 and 18, 1919, under the Presidency of I. L. Oppenheimer, Pomeroy, Ohio; D. L. Gaskill, Greenville, Ohio, Secretary.

A general invitation was sent out to all Electric Light Companies in Indiana, Kentucky and Michigan, to send representatives to this meeting, and a large number accepted the invitation and were present. The attendance was larger than at any previous convention, and the same may be said of the exhibit by manufacturers and supply men.

FIRST SESSION—TUESDAY MORNING, JULY 15, 1919

The convention was called to order at 10:00 A. M. on Tuesday, July 15, 1919, by President Oppenheimer, who said:

We will proceed with the regular order of business,

> "Breathes there a man with soul so dead,
> Who never to himself has said,
> This is my own; my native land.
> Whose heart ne'er within him has burned,
> As homeward his footsteps he has turned,
> From wandering on a foreign strand."

My friends, these lines of Scott committed to memory in my boyhood days arose in my thoughts when I boarded a train in the peaceful mountains of Old Virginia and sped homeward to this, "My own; my native land." The great and prolific state of Ohio, within the borders of which there is maintained the largest, the best, the most progressive and most aggressive Electric Light Association of any State

in the Union can boast of an association that has grown in importance to a strong, potential and constructive force by the co-ordinated efforts of its members and the untiring and unselfish labor and time contributed by its Committee. And I want to say, that there is not a member of the association, either Active or Associate, who has not received an equivalent in the ratio of more than ten to one for every dollar that he has invested. I say "invested," because it is an investment and not an expense to maintain membership in this organization.

In saying the above I have just drifted a little bit from my address, which is the first thing in order. It will be brief, I am not going to detain you very long, and I would be glad to have your attention while I read it, as follows:

PRESIDENT'S ADDRESS

Gentlemen of this Association:

We meet again in this our Twenty-fifth Annual Convention, to review the work of the past year; to formulate our plans for the future; to exchange greetings; to renew friendships and acquaintances and to promote good fellowship and understanding between representatives of the companies here assembled.

To all the members, to all our guests, and especially to all our visiting ladies, whose charming presence add inspiration to our labors and festivity to our recreative hours, I want to extend a most cordial welcome.

A splendid program has been carefully prepared that will prove interesting, instructive and entertaining, and which I feel sure will hold your attention until the hour of adjournment.

One year ago, when you chose me President of your Association, our country was in the throes of the most terrible, inhuman and devastating war ever recorded in the annals of history. A war archaic; precipitated and pursued for the purpose of conquest; for world power and domination; for destruction of democracy and to force all nations and peoples to pay tribute and homage to an imperialistic dynasty, which like Mahomet willed to win by force, dwelling under the primeval doctrine that "The state has no conscience"; "The state can do no wrong"; and under whose reign, government and freedom was a mockery.

No one dared venture a statement when the war would end. We approached the coming year with fear and trembling. We could not con-

jecture one day what the next might bring forth. We knew not at what hour our ship might be dashed upon the shoals and wrecked. It took men with courage, with strong hearts, and clear heads, to meet the uncertain conditions then prevailing, conditions that threatened to rend asunder our civilization; conditions that threatened the very foundation of our society, our economics, our religion; and there is not an industry of any nature, that has been compelled to meet the obstacles or suffer the trials, hardships and losses that confronted and was sustained by the public utilities of every nature throughout our entire land.

The war is over. The end resulted in the only way it could result, the triumph of right over might, of righteousness over unrighteousness, of honor over dishonor, of truth over falsehood, of justice over iniquity, of democracy and freedom over imperialism and slavery.

We thank God that his Light prevailed as it has in the past and ever will in the future; that the blood of our brave American soldiers was not shed in vain, and that those responsible for the terrible conflict, with its appalling loss of life, with all its misery, its destruction of property, its desecration of the products of nature and man, its disturbance of the basic principles of society, have been defeated and reduced to a state of subjugation that will forever preclude the possibility of again threatening the peace of the world and its institutions.

Yes, the war is over; but many of our trials have just begun. We face a period of reorganization and reconstruction. It will require real statesmanship; it will require genius and deep economic thought to restore our industries and commercial pursuits to the former pre-war basis. In this, the efforts of this Association, by its members collectively and individually must be put forth to the fullest extent. One of the things that will aid to inspire us with energetic action, is the result of the decision that was made some time ago by the Executive Committee, to hold this year an old time pre-war convention, with exhibits and entertainment that would interest and buoy the spirits, and stimulate the activities of all attending. The opening day of the convention bids fair to fulfill every expectation the committee had in mind and I believe it will prove to be the largest, best, most enthusiastic and profitable meeting ever held by the Association.

As a result of the war and the period of reconstruction that will follow, I believe the electrical industry stands upon the threshold of the greatest, most constructive and most productive period in the history of its exist-

ence. A great improvement in the spirit of public relations is manifest on every hand; the public is awakening to a sense of duty and obligation it owes to public utilities and the necessity of allowing such utilities to prosper. This will be followed by more favorable legislation that will insure just recognition and consideration to vested interests and protect them against the assault and destructive elements of political intrusion. The psychological time is at hand, and those identified with the industry will be unfaithful to their interests if they fail to take advantage of the opportunity that stands at our portals.

The year's work of the Association began under most unfavorable conditions. The prevailing epidemic of influenza invading our ranks in every department from executive head to the most menial laborer, and necessitating regulations against public meetings, caused repeated postponements of scheduled committee meetings; and it was not until December 10 that active meetings began to be held. From that time the work proceeded with unusual zeal and vigor, which is attested by the fact that during the remainder of the year there were held fifteen open meetings at various points in the state. The report of the work accomplished by our nine committees including one sub-committee will be placed before you and discussed during the progress of this convention; I, therefore, will not dwell or comment upon the work except to say that this Association is indebted to the members of the various committees for the time and unselfish labor they have devoted to the task, the benefits of which will be reflected in every branch of the industry.

BUSINESS DEVELOPMENT.

Never in the history of the industry have there been afforded greater opportunities for development. Electricity, like many other commodities that enter into our daily life and that once was considered a luxury, has become a necessity to our existence. We are living on a higher civic plane than ever, which will not only encourage, but will demand greater comforts and refinements. Both industrial and domestic electric heating are going to come into use with increasing alacrity and will offer to the industry a most fertile field of future development that should be met with acumen and pursued with intensive efforts.

LEGISLATION.

It is a source of satisfaction to report that during the last session of

the State Legislature, only recently adjourned, no legislation was passed that will impose a hardship on the already heavily-burdened utilities, and it is to be hoped that the future will demonstrate to our legislative bodies the necessity of laws that will protect as well as regulate public utilities that represent an investment of hundreds of millions of dollars and play such an important part in our civic life and in the advancement of art, science and industry.

ASSOCIATION MONTHLY.

The Association Monthly, so ably edited by our Secretary, has continued to go forth to the membership each month, and not only has it been a medium of good and cogent influence in disseminating the current work of the Association, but it also continues to be a financial success, yielding returns that materially aid to meet the expenses of the Association. I hope it will continue to be edited and published with the same degree of success that it has sustained in the past.

FINANCES.

The finances of the Association, as will be revealed by the report of the Secretary-Treasurer, are in fair condition, but will be inadequate to meet the growing demands, and the time has arrived when a new financial plan should be inaugurated. A large proportion of the finances has been provided by the personal efforts of our Secretary in the revenue he has secured through the advertising pages of the Monthly; and while I am certain that he will continue to fully devote his talents and energy in producing the maximum financial returns from that source, I think it is unfair that he should be burdened with the responsibility of providing funds through his personal efforts to sustain the work of the Association. A more definite and fixed source of income should be provided. Approximately 140 companies, representing an investment of nearly $200,000,000.00 comprise the active membership of this Association; the annual dues have been low compared with the returns that have been yielded, and I believe an advance of membership dues is essential. I earnestly urge that this receive serious consideration and some action be taken at this time that will in some manner provide for additional funds.

MEMBERSHIP.

Within the past few years little has been done to increase our member-

ship. Of the companies operating in the state there are but few not members of the Association and it is not likely that more than three or four could be added. But there is an opportunity of increasing our associate and engineering membership, of which we have at present, approximately seventy. I recommend that an aggressive campaign be inaugurated to secure a larger associate and engineering membership, which I firmly believe can be easily doubled.

CONCLUSION.

In conclusion, I want to thank all the officers for the generous support they have given me. I want to thank all the committees for the time and labor they have so generously devoted to the good of our industry, and to our Secretary I want to give special expression of my thanks and gratitude. Upon his shoulders I have shifted nearly all the responsibilities of my office; he accepted them in the even tenor of his way; he discharged them with that rare judgment and wisdom that characterizes all of his work and actions. The Association is indeed fortunate to be able to command the services of such a man. We all know that he is daily supplying a constructive and potential force to the affairs of the Association and the industry. I believe every member present will join in conceding what I have said. I believe in acknowledging such work and ability, and giving adequate expression of our thoughts while he is with us in full consciousness of our tribute and not wait until "Life's evening tinge his brow with sunset glow."

In briefly reviewing some of the work that has been done in the past year, I feel conscious of the fact that I have contributed but very little. That I have not been more actively identified with the work, has been due to ill health and circumstances entirely beyond my control. Upon retiring from office, I solicit your generous indulgence for any failure to measure up to your expectations, when one year ago you honored me with the Presidency of your Association.

J. L. OPPENHEIMER.

President Oppenheimer: Next in order is report of Executive Committee. That committee, however, has no report to present at this meeting. I will call for the Secretary-Treasurer's report, which is next in order on the program.

Secretary Gaskill: Mr. President and Gentlemen of the Assso-ciation, following the custom of many years the Executive Committee will not make a formal report, because practically all that the committee did is concentrated in the President's Address and the Secretary's Report. I have the honor to present my report as your Secretary-Treasurer as follows:

SECRETARY'S REPORT

July 2, 1919

To the Members of the Ohio Electric Light Association:

I have the honor to submit this my Report as your Secretary-Treasurer for the twenty-fifth year of the Association ending July 2, 1919.

The financial report is as follows:

Balance on hand at last report	$ 2,205 94
Received from dues of active members	1,534 75
Received from dues of associate members	640 00
Received from dues of engineering members	35 00
Received from cuts sold	2 53
Received from forms sold	2 50
Received from advertising in Monthly	2,973 98
Received from members' subscriptions to Monthly	275 00
Received from exhibit space 1919 convention	100 00
Total receipts, including balance	$ 7,769 70

Expenditures,

Expenses of Executive Committee	$ 147 65
Expenses of Transmission and Distribution Committee	357 62
Expenses of Station Operating Committee	348 41
Expenses of New Business Co-operations Committee	313 02
Expenses of Meter Committee	163 61
Expenses of Illuminating Committee	49 97
Paid for cuts and engravings	23 73
Paid for general printing	75 25
Paid for reporting 1918 convention	173 20
Paid for printing Monthly	1,698 15
Paid for reports	10 00

Paid for legislative reports and registration fee	203 00
Paid for sundry expenses 1918 convention	52 71
Paid for postage for year	119 04
Paid for telephone, telegraph, express, etc., for year	29 89
Paid for traveling expenses	426 95
Paid for stationery and supplies	8 05
Paid for secretary's salary and clerk hire	2,300 00
Paid for members' subscriptions to Monthly	275 00
Total expenditures	$ 6,775 25
Balance on hand	$ 994 45
Total	$ 7,769 70

As will be noted, there is a less balance on hand than existed at the convention last year. This is accounted for for the reason that no convention was held in 1917 and the activities of the Association had been much curtailed. In 1918 and 1919 it is a pleasure to report that the activities of the Association have been greatly increased. In fact, in no year during the history of the Association has there been so much done by the committees as well as the officers as during the past year. This is particularly gratifying because it shows that the return to association work has been complete, and promises splendid results for the future.

I can speak in but high terms of the work of our standing committees. The Association has five Standing Committees that hold meetings at different locations throughout the state during the year. These committees are the New Business Co-operations Committee, divided into two sections—Commercial and Merchandising Section and Industrial Power and Heating section; Station Operating Committee; Transmission and Distribution Committee; Meter Committee; and the Illumination Committee. Each of these committees have reports to make for this convention, and the details of their work will be thoroughly gone into, but as the Secretary has been in close touch with their operation I wish to say a little commendatory of the wonderful work and service that they are doing.

The Station Operating Committee during the war period has had a great number of hard problems to meet, and they have done so in such a splendid manner that their work hasbecome national in its scope. The

Meter Committee has continued its splendid work of the past and has added to the laurels it had already gained in the electrical field throughout the United States. The New Business Co-operations Committee has had its work somewhat curtailed during the war, but the spirit and splendid results obtained show that the committee is ready for the task that lies before it in taking care of the post-war business. The Transmission and Distribution Committee has done most splendid work. The problems that this committee have had to deal with at the present time are harder than at any time in its existence because of the near approach to the publication and adoption of the Electrical Safety Code, and this Committee has done splendid service in preparing for the work.

The Illumination Committee work deserves more than passing notice. The Committee under the splendid leadership of its Chairman and the two other members has probably set the hgh-water mark in committee work throughout the United States. Not only have they conducted a series of meetings to bring about better illuminating service within our State but they have also performed prodigious labors in assisting the Utilities Commission of the State in making workable the new factory lighting code. They have also inaugurated and are carrying out a course of instruction in illuminating engineering which is pronounced by engineers throughout the country as the best yet put forth, and it certainly is an honor to the Association and a satisfaction to the officers to have a committee that is leading the work such as the Illumination Committee at this time.

In all our committees the work has been exceptionally fine during the past year, and I would urgently recommend that the Executive Committee continue the policy of the past of paying the expenses of the committeemen in attending the meetings and giving every encouragement to them in their work.

The Monthly of the Association continues to be a source of profit to the Association. The total receipts for the past year from advertising were $2,973.98; the total cost of printing the Monthly for the twelve months was $1,305.80, leaving a net profit to the Association for the year of $1,668.18. This profit would justify the issue of the Monthly, but it represents very little of the value of the publication to the Association. By its use the standing committees are given a place in which their papers and reports can be sent to all of the members, and its issue does much to keep alive and assist in the work of the Association.

I would urge that a committee be appointed to assist the Secretary in procuring a greater amount of advertising for this publication. We have been fortunate in the past in being favored with the continued patronage of the leading concerns of the country serving the electrical field, but there is no reason why double the amoun of advertising should not be had in each issue of the Monthly.

As will be noted, the receipts from membership dues remains practically the same as before. This is because there has been no concerted effort made during the past five years for an increase in membership. It is hardly possible to increase the Active Membership of the Association as most of the central stations of Ohio are now members. Some few have passed out of existence, and one group of companies have failed to maintain their membership in the Association. In the Associate and Engineering memberships a considerable increase can be made. We should have fifty more Associate Members and at least that many more Engineering Members. This can be done by putting on an active campaign for members sometime in the fall of 1919, and I recommend that the committee be appointed either by the convention or by the Executive Committee to undertake that work.

The Executive Committee this year have provided an exhibit as a part of the attractions of the 1919 convention. This exhibit is of particular interest at this time because there are many things exhibited which are new and instructive in the electrical industry. The profit to the Association from the exhibits will exceed $1,500.00, and I believe that the members of the Association can show their appreciation no better than by giving their time and inspecting thoroughly every exhibit on the floor. Every effort has been made to make it instructive as well as beautiful, and we should show our appreciation by remembering the exhibitors who have helped to make our convention a success.

This Association completes its twenty-fifth year of its existence at this convention. Its history has been one of success, and the good it has accomplished for the electrical industry is probably beyond calculation. It can still be made more useful and better by the active co-operation of its members. It is well to remember that the convention is but the smallest part of the Association's work. Each month something is done to help and assist the member company, and with the active co-operation of all of the association we can still accomplish more good.

I would recommend that the Executive Committee give careful con-

sideration to the matter of changing the method of collecting dues from the population method to a percentage of the gross receipts of the companies. I believe that this would bring about fairer and more equitable distribution of the expenses, and would result in more finances to the Association.

In closing my report, I wish to express my appreciation of the splendid support given me by all of the officers and members of the Association. The work is a pleasure with such co-operation and assistance, and I trust that the coming year will be full of usefulness and prosperity to the Association.

Very respectfully submitted,

D. L. Gaskill,
Secretary-Treasurer.

On motion of Mr. J. C. Martin, Columbus, the foregoing report was referred to the Finance Committee for audit and report.

President Oppenheimer: Next in order is appointment of the Committees. The only Committee to be appointed at this time is the Nominating Committee which should be constituted at once so that they will have ample time to secure a good ticket for the ensuing year. Following the precedent of the past, one of this Committee will be appointed by your President, two by the Executive Committee, and two will be elected by the convention. Your President will appoint Mr. George E. Miller, of Cleveland, who will act as Chairman of the Committee. The Executive Committee has chosen Mr. William Long, of Toledo, and Mr. E. H. Beil, of Youngstown. We are now open for nominations from the floor for two other members of that Committee.

Mr. C. H. Spiehler, Dayton: I nominate Mr. J. B. Johnson of Elyria.

Mr. E. H. Beil, Youngstown: I nominate Mr. J. C. Martin of Columbus.

President Oppenheimer: Are there any other nominations? If not, we would consider the nominations closed.

On motion, nominations closed, and Messrs. Johnston and Martin were unanimously elected as members of the Nominating Committee.

Secretary Gaskill: I want at this first session to make a few announcements, and we would like to have all attending remember them if possible. As you will note, we have a very excellent program arranged for three days and a half, and that we have not overcrowded any session but have followed the rule that past experience has demonstrated to be wise, that not more than two subjects should be considered at any one session, and in one session that we have only one lecture will be given. You will also note that we offer you more variety this year than usual in that we have provided for an address or paper at every session, so that matters of a scientific and general nature are so blended that you will not be tired of any session. The meeting was held this morning in this room in order to give the exhibitors an opportunity to complete the putting up of their exhibits without disturbing you with their noise; but all other sessions will be held in the convention hall above the exhibit room.

You will note that the hours fixed for the sessions to begin are 10:00 o'clock in the morning and 2:30 in the afternoon. This will give you ample time for visiting before those hours. We cannot have a successful convention if you are going to come straggling in to these sessions anywhere between 10:00 and half-past ten in the morning and 2:30 and half-past three in the afternoon. It is hoped that you will be prompt in your attendance at each session in order that you may have ample time to finish the program at each session and also spend some time with the exhibitors. Upon that subject I want to say just a word. When you go down there and see that exhibit you will have to admit that it is the best that this Association has ever had. It is as large as the exhibit of the National was three or four years ago, although not as big as the one they had this year; but it is a splendid exhibit. I want you all the time to remember that these exhibitors have brought their displays here not only for you to look at, but also to meet you; I want to personally plead that every one of you make it a point to talk to every exhibitor there some time during the convention. The Executive Committee have fixed the hours for the exhibit so that those in charge of the exhibits will not have to stay there when everybody else wants to go into the lake. We fixed the hours this morning from 9:00 A. M. to 5:00 P. M.

On Wednesday evening there will be a lecture on Illumination by Mr. Durgin, which will occur in the room above the exhibit hall. This will

be illustrated by apparatus, stereopticon views and other methods and immediately following the lecture there will be an Exhibitors' Carnival on the floor below. The ladies are particularly invited to attend not only the lecture but the carnival and the whole evening will be spent there. I understand that plans are on foot for an informal dance that night after the lecture.

Now, entertainment has been provided for the ladies as shown on the little Entertainment Program. There is no scheduled entertainment for the ladies until to-morrow. The entertainment that is provided for the men consists of the Exhibitors' Carnival following the lecture, and on Thursday night the Annual Banquet of the Association, which is strictly informal. There is not a dress suit on the Island, or if there is, it will be sent out this morning. Your shirt waists will be entirely welcome if you desire to go that way. The Entertainment Committee have provided certainly one of the most delightful banquets that we have ever sat down to along with a line of entertainment both new and novel. I am not at liberty to state what it is. After the banquet will be held the Annual Ball of the Association in the dancing floor above the colliseum.

I do not know that I have any other announcements to make at this time other than to ask that you help us to make this a good convention.

Your officers cannot make a good convention; we cannot get you to the meetings, nor can we make good meetings, but if you will put into the Committee the same vim and vigor that you put into your own business it cannot be but a success.

Be promptly on hand, and remember that the exhibit is an essential and excellent feature of our convention this year.

I forgot to mention one unique feature that will come off at the banquet Thursday night. There will be a goodly number of the Past Presidents in attendance, and I believe we will be honored by the presence of the first President we ever had. Suitable tokens will be presented to those Past Presidents that are here, and the presentation will certainly be one of the pleasant features of the banquet in honoring those who have served us as Presidents of the Association in the past.

It is still early, and we have made an assignment on the program for a "Round Table on Association Work," and before we adjourn we would like to have the chairmen of the various standing committees

occupy at least a half an hour discussing Association work and telling your Officers what you would like to have done. (Applause).

Mr. J. C. Martin, Columbus: Supplementing what our Secretary has said, and if he will pardon me, I want to say that this program is filled with excellent addresses. Those of you who heard Mr. Gordon's speech at the National Electric Light Association will agree that it is a talk that is worth paying $1.50 for any time, and you would very readily pay that amount any evening to hear such an address in your home town. That address here is free, and the Association has provided it for your entertainment and your instruction. I think that every Central Station man, every man that has a dollar invested in public utilities and every man who recognizes the trend of socialism throughout the country should hear Mr. Gordon and pay close attention to what he may have to say.

I have also heard Colonel Cole on several occasions. He will speak on a popular subject and he is well up toward the head of the list of entertainers throughout the country.

It is very discouraging to such speakers as these men to address only a small audience. It is quite discouraging to a man who has spent hours probably in preparing his address to come before an audience made up of fifty or seventy-five people to hear what it cost him thought and worry of perhaps weeks or months to prepare. It is not fair to our invited guests who come to address us and who are here upon our invitation, not to give them an audience of good size. We would not treat guests in our house that way. These men are our guests and every one of us should make an effort to see that not only all of our membership are in attendance but any other persons who care to hear these addresses so as to help make the crowd to enjoy the feast that is prepared for us. The addresses, as you will note, are assigned the first places on the program at each session so that any one dropping in who is not interested in the technical reports that follow the addresses can listen to the address and then go pleasure seeking if they so desire, and those interested in the technical features can remain.

I would like to say also on behalf of our President, as one who has tried it two years, to open a convention session with only twenty-five to thirty members present. It depends very largely upon the President to keep things moving, and you can move a large body more easily

than you can a smaller one, because once you get them started an expression from one will create thought in the minds of others and interesting discussions will be brought out. The reports and the proceedings of this convention will be filled with practical ideas from a practical standpoint. It will be a real up-to-date convention. Let us each be a Committee of One to get the other fellow there, and if every one will see that he is there and that his neighbor is there, we will surely have a good convention.

President Oppenheimer: Is any one else ready to take up some subject or offer any discussion?

Prof. S. C. Caldwell, Columbus: I would like to say a word with regard to the address by Mr. Durgin on Wednesday afternoon. Your Committee on Illumination feel that in persuading Mr. Durgin to come here and give the address which he gave at the meeting of the National Electric Light Association at Atlantic City we have done a particularly happy thing. I did not hear it at Atlantic City myself, I was not so fortunate, but those who did speak of it in the highest terms. It is like all of Mr. Durgin's lectures, for it really is a lecture rather than an address and it presents the subject of Illumination in a way that it would hardly be possible to do in any other form; so that I wish to bespeak a very large attendance for that lecture of Mr. Durgin, Wednesday evening.

President Oppenheimer: Has any other member anything to offer at this time? The hour is early. Is there any subject you would like to discuss before we adjourn? If so, we would like to hear from you.

Gentlemen, I hope you will observe very closely the remarks of Mr. Martin a few moments ago with reference to getting out a full attendance. He was quite correct in stating that it is discouraging to a presiding officer and the other officers of the Association to find such a light attendance. This is the lightest opening attendance I have ever experienced in a meeting of the Ohio Electric Light Association. It does not represent the importance of the Association nor its membership. I hope that you will make a special effort at the afternoon session to corral all these dilatory members who are somewhere about the

grounds not attending the convention, in which they are not fair to either the convention or themselves.

If there is nothing further the convention will now stand in recess until 2:30 this afternoon when we will meet on the second floor of the Exhibit Hall, where we hope to have a good attendance. We trust that you will give some time to the exhibitors who are giving their time and money to place a good display before you at this time.

The convention now recessed until 2:30 this P. M.

SECOND SESSION—TUESDAY AFTERNOON, JULY 15, 1919

The convention met, pursuant to recess, the President, Mr. I. L. Oppenheimer, in the chair.

President Oppenheimer: The convention will now come to order. The first order of business for this afternoon's session will be the report of the Station Operating Committee, Mr. Henry B. Dates, Cleveland, chairman.

Secretary Gaskill: Mr. Dates wrote me that he would be in Schenectady, and stated that Mr. Bromley, of the Committee, would present the report. I have not seen Mr. Bromley here to-day, and understand that he is on the road. There is a gentleman here who will present Mr. Strike's paper this afternoon. If you wish me to, I will read the Station Operating Committee's Report, if that is satisfactory.

Secretary Gaskill read the report as follows:

REPORT OF STATION OPERATING COMMITTEE

We present herewith the report of the activities of the Station Operating Committee for the year 1918-1919.

The Committee met at Columbus in September, 1918, to formulate plans for the year's work. At this time, the country was engaged in the active prosecution of the war, and the committee planned its work with a view of helping the operating men of the Association in the direction of conservation and the more efficient operation of their plants.

The committee has felt that its work is to a very large degree, of an educational character; that it could best fulfill its function in the organization by so conducting its meetings as to bring to the attention of the operating men, the latest improvements in instruments and apparatus, and more particularly by putting the engineers in touch with the best methods of station organization and operation. Its work has accordingly been conducted upon the above plans, and the committee has especially promoted a free round table discussion among the members on their operating practices and their station troubles and how they have been overcome, besides having, from time to time, more or less formal papers, by practical men, presented for discussion.

Undoubtedly the promotion of acquaintance among the engineers of the various plants and the informal talks and discussions of the men between themselves at the meetings has been a very large and valuable feature of the committee work. It has been particularly noticeable that, during the sessions, men have talked over their troubles with each other and in many cases it is known that valuable suggestions have been given and received, all making for better efficiency in the plants of the Association.

Another valuable feature of the meetings under the auspices of your committee, has been the opportunity to visit some of the newest and best of the power stations, in which the very latest apparatus was open for inspection, and where the engineers had opportunity to leisurely go over the plant and discuss with men in charge, the features of design, construction, operating practices and methods of station operation in very considerable detail.

It is, of course, difficult if not impossible, to give a quantitive estimate of the value of the Station Operating Committee's work. There is, however, we believe, no question of the actual value of the work of such a committee in the Association, and probably in no other way could so large a number of men be reached and the latest practices be brought to their attention at so small a cost. It is a great pleasure to the committee to express their appreciation of the very hearty co-operation they have received in this work from all of the companies represented at the meetings. The delegates have taken a very active part in the meetings. The companies in whose cities the meetings were held have most loyally supported the work and to this widespread and hearty support is due whatever results have been obtained.

Work in Detail: Your committee was instructed at the beginning of the year not to curtail its work in any way whatever, because of war conditions; and accordingly, one day conventions were planned to be held in November, March and May at Cincinnati, Youngstown and Dayton respectively, with an open committee meeting at Detroit in February. Anticipating, in the fall, that severe operating conditions would be met with during the winter months, no large meetings were scheduled from November to March. Because of the influenza epidemic, however, the November meeting was changed to December and the actual meetings held were as follows:

Cincinnati Meeting	December 10, 1918
Detroit Meeting	February 14, 1919
Youngstown Meeting	March 12, 1919
Dayton Meeting	May 13, 1919

The subjects presented at these meetings were as follows:

Cincinnati—"Fuel Economy in the Boiler Room." By J. G. Worker, Manager of the Stoker Section of The Westinghouse Electric & Mfg. Company.

"Practical Phases of Boiler Room Practices." By Edward Marshall, Combustion Engineer, of Union Gas and Electric Company.

"Fuel Conservation from the Standpoint of United States Fuel Administration." By M. S. Hopkins, Administrative Engineer for Ohio.

Detroit—The general subject of the open meeting at Detroit was: "Efficiency Operation," and a number of informal and illustrated talks

were given by members of the engineering and operating staff of the Detroit-Edison Company; and visits were made to both the Delray and Connors Creek plants. The committee and delegates attending the meeting were guests of the Detroit-Edison Company for the day.

Youngstown—At this meeting, Mr. W. M. Polakov gave the principal address on "The Application of Scientific Management to Power Production."

Dayton—This was a round table discussion on the subject of "Present Operating Economy." A description of the new Miller's Ford Power Plant of The Dayton Power and Light Company, together with its present operating economy was given by Mr. C. H. Speihler, and Mr. Wm. Shuler. Mr. C. W. DeForest presented the data on the new station of the Union Gas and Electric Company, Cincinnati, together with resume of their turbine troubles and their remedies. Mr. J. M. Strike gave a description of the present operating practices and economies at the Acme Power Plant, Toledo. Mr. Geo. W. Burns of Cincinnati, gave a short address on "The Labor Problem and General Industrial Situation."

It will be noted from the topics mentioned above as having been presented and discussed at the various meetings, that the keynote for the year has been "Conservation and Economy."

At the first meeting of the year, Mr. W. W. Freeman of the Union Gas & Electric Co., gave a splendid luncheon address, emphasizing the important lessons of the war and the necessity of continuing with conservation policy adopted by all of the companies.

In spite of the disorganizing effect of the war, it has brought home to us, as never before, and probably as would have been brought in no other way the importance of conservation and more efficient practices in our stations and the stimulus to more efficient station operation has been great, and the progress made in our various plants toward a more permanent increase in economies is very gratifying.

At the Youngstown meeting, Mr. Polakov pointed out, that during the war, the importance was realized of well-organized production; that such organization was equally as important to the efficient production of electric power as to the production of manufactured articles. He spoke in particular of the application of scientific management to power

production. Some of the points brought out in his paper are well worth emphasis such as—

"Methods of scientific management met in other industries with a measure of opposition from organized labor because in many cases it was aimed at higher profit not at general betterment. Intensification of production was feared lest it overspeeds some men and throws out of employment others.

"In power industry such fear is unfounded for higher efficiency of firemen, engineers, etc., *affects* quality of their work, not quantiy of output and is necessarily accompanied by reduction of fatigue producing operations.

"Lantern slides were shown in the course of the talk, illustrating the actual progress of work and of application of scientific management to power industry. Emphasis was laid on the spirit of democracy permeating the industrial relations thus established; for the success of the undertaking is based on co-operative efforts based on facts, not on opinions and arbitrary orders. True leadership of men is that of showing the way and helping to reach the goal, not by driving and forcing. Principle of *Service and production for the common good* should guide engineers' work.

"Many examples were given of plant record and results attained under the mode of management advocated. In some instances the comparison of old and new records and comparison with other similar plants clearly demonstrated superiority of scientific methods. It was also shown that the overhead administrative expenses do not increase when new managerial mechanism is introduced.

In this connection, Mr. Biel of the Mahoning and Shenango Railway and Light Company called attention to a paper before the Pennsylvania Electric Light Association, describing such a method of scientific management as introduced into several plants wherein the author said in speaking of the success of the value of system as follows:

"The success of the system in use in our power plant is dependent upon a perfect spirit of co-operation between the management and the workman. The management is compelled to accept its proper share of the responsibility and must keep in touch with the latest development of boiler room practice. Attention is given to suggestions made by the workmen; and in case such suggestions are adopted an effort is made

to give full credit to the originator of the idea. The workman's responsibility commences as soon as the standard has been established and is placed in proper form before him by the management. Too much stress cannot be laid upon the importance of following exactly the instructions covering the workman's duties. Furthermore, rigid inspections must be made periodically by a duly authorized representative of the management, in order to guard against any deviation from these instructions so that there will be no danger of the practice being modified either arbitrarily or unconsciously by some unqualified person. Changes in the methods are made only after the receipt of definite written instructions cancelling those in use.

"Not only have the results of the introduction of the new boiler room practice been more than gratifying from the standpoint of reduction of expense to the company and improvement in the conditions affecting the workman and his compensation, but it has also increased the mutual respect between management and workman and has developed the esprit de corps which is so beneficial to both. The workman is as much interested in the success of the methods and the standards which have been established as is the management. It is not a case of 'I' on the part of the superintendent and 'you' on the part of the workman, but 'we' are working together to obtain the highest efficiency in 'our' boiler room."

Mention was made in the first part of this report of the opportunities which have been afforded the delegates to the meetings to visit some of the new power plants in the state and see at first hand methods of operation and apparatus in use. In these informal visits, much valuable information has been given out and the interchanges of ideas between the men cannot but be of great value to the companies of the Association.

In connection with the meetings this year, visits were made to the Lowellville Power Plant, of the Mahoning & Shenango Railway & Light Company, the new plant of the Union Gas & Electric Co. of Cincinnati; the Miller's Ford Station of the Dayton Power & Light Co.; the Delray and Connors Creek Station of the Detroit-Edison Company. Also, to the new electrically equipped plate mills of the Brier Hill Steel Company, and the M. & S. Substations connected therewith and to the substations of the Dayton Power & Light Co. at the McCook Aviation Field.

A great deal of very valuable information was brought in the round table discussion of present operation economies at the Dayton meeting, and believing that a brief description of some of the new power stations in the state and their present operation economies would be of both interest and value to the engineers of the Association, the committee appends herewith a short outline of the apparatus and results obtained at a few of our new stations.

The Union Gas and Electric Company

The new power plant is located on the north bank of the Ohio River at Cincinnati, and was designed for a total capacity of 100,000 Kw., made up of 4—25,000 Kw. turbines. The buildings and foundation are completed for the total capacity, but only two turbines and the accessories have been installed and in operation to date. The main equipment installed to date is as follows:

Turbines: 2—25,000 Kw. (31,250 KVA) 3 phase, 60 cycle, 13,200 volts, General Electric single cylinder, horizontal, 17 stage, 1800 RPM turbine units. Steam pressure at throttle 230 lbs., 250 deg. F. superheat, back pressure in exhaust chamber not more than 1 inch absolute. Guaranteed economies—

Load	*Lbs. Steam per KWH.*
15,000 Kw.	11.15
20,000 Kw.	10.7
22,000 Kw.	10.6
30,000 Kw.	10.8

Weight of unit per rated Kw. equals 25 lbs.
Floor space per rated Kw. equals .0384 sq. ft.

Boilers: 8—B. & W. cross-drum, 1262.5 rated H. P. each, heating surface 12,625 sq. ft., 250 lbs. steam pressure, 250 deg. F. superheat, temperature of steam 656 deg. F., rated continuous capacity per boiler—100,000 lbs. of steam per hour, maximum capacity per boiler—120,000 lbs. of steam per hour. Boilers are equipped for burning either coal or natural gas.

Boilers are fired by Westinghouse underfed 14 retort stokers of 13,000 lbs. of coal per hour capacity. Each pair of stokers driven by 35 H. P. 600 volt direct current motor.

Economizers: The economizers are made by the B. F. Sturtevant Company, rated at a maximum operating pressure of 325 lbs .per sq. inch, with a heating surface per boiler—8256 sq. ft.

Condensers: One Worthington vertical surface condenser of 330,000 lbs. of steam per hour capacity, 52,000 sq. ft. of condensing surface, per turbine, equipped with Worthington circulating condensate and air pumps.

Exciters: One 250 volt direct connected 140 Kw. exciter on end of generator shaft of each turbine.

One 200 Kw. General Electric steam turbine driven exciter.

One emergency 400 ampere hour storage battery, battery capable of supplying excitation for two turbine units for half-hour period.

Switchboard and Switching Equipment: Switchboard and switching equipment throughout of Westinghouse manufacture. Bus layout and electrical work planned on basis of eight units and consists of double ring system with 5 per cent bus reactance between feeds from each unit and 3 per cent reactance on feeders, with separate power transformer and bus for auxiliaries of each main unit.

Operating Results Obtained to Date and Factors Contributing to Low Operating Costs: The plant is designed to obtain the maximum output with minimum labor and maintenance costs. When operating both turbines, the operating force consists of the following men on an 8-hour shift basis:

Boiler room—4 firemen, 1 water tender, 1 pump man, 2 economizer men. Total 8. 1 boiler room foreman on day shift.

Turbine room—1 engineer, 1 turbine operator, 1 oiler, 1 condenser operator. Total 4. 2 screen operators on day shift.

Electrical—1 switchboard operator, 1 telephone operator, 1 electrician, 1 crane operator. Total 4. 3 maintenance men on day shift.

With a very few additional men, the plant could be operated at its full capacity of 100,000 Kw.

An over-all plant efficiency, based on BTU per pound of coal as fired, of 18% to 19% has been obtained.

When burning gas, fuel economy in the equivalent pounds of coal of 1.26 lbs. of coal per Kw. H. generated, 1.32 lbs. of coal per Kw. H.

send out, have been obtained. Average monthly economies when burning both coal and gas of 1.37 lbs. of coal per Kw. H. generated and 1.46 lbs. of coal per Kw. H. send out, have been made. These economies can stell be bettered when the construction work, which has been going on in connection with the present turbines has been completed, as higher load factors will then be obtained on the turbine units.

The main points contributing to low operating costs and high efficiencies obtained are as follows:

(1) The small operating force required to operate this plant.

(2) The low steam rate of the G. E. turbine on light load. From tests made on the turbines on light load, the following steam consumptions were obtained:

10,000 Kw.—10.84 lbs. of steam per Kw. H.
15,000 Kw.—10.75 lbs. of steam per Kw. H.
22,000 Kw.—10.6 lbs. of steam per Kw. H.

These rates on light load are better than the guaranteed economies and enable the turbine to take care of a wide diversity factor without any considerable loss of economy.

(3) With the exception of three boiler feed pumps, one service pump and one steam exciter, there are no steam driven auxiliaries. All the other auxiliaries are motor driven. Accordingly there are no taps with corresponding losses off of the main steam headers with the exception of the above steam driven auxiliaries.

4. There is no excessive amount of exhaust steam. The feed water is heated to only 110 deg. F. in feed water heater, then 130 deg. in the economizer. Gases leaving boiler never exceed 600 deg. F. and 300 deg. F. when leaving the economizer. Any additional exhaust steam needed is supplied from the 17the stage of the turbines through thermostatic control valve operated by the feed water heater temperatures. Average CO_2 on coal fired boilers is 12% to 13%; on gas fired boilers 9½%.

(5) Make-up water required for boilers averages less than 5%.

(6) Boilers have steel casing covering with air-tight joints and radiation losses and air leaks are minimized. All joints on high pressure steam piping are welded.

(7) Condensers are vertical type and are practically self-cleaning. Each condenser is equipped with a preheater of 12,000 sq. ft. of heating surface, which heats water from the hot well from 4 to 5 deg. F.

(8) Coal pits installed in the boiler room flor of total of 7,000 tons capacity, eliminate large overhead bunkers, thereby eliminating investment costs, and one crane operator can handle 120 tons of coal per hour from pits to bunkers.

Bnuker for each boiler is only of 100 tons capacity.

(9) Daily checks and analyses of operating results are made and studied, including checks on approximate coal analyses of coal as fired, per cent combustible in ash and over-all plant efficiency, and fuel economies.

Condensed Description of the Walnut Station of the Columbus Railway, Power and Light Company

Location. Located about 10 miles southeast of Columbus, Ohio on Big Walnut Creek and the Hocking Valley Railroad.

Building. Hard burned brick, with reinforced concrete foundation and asbestos steel reinforced floors and roof.

Stacks. Two reinforced concrete stacks, inside diam. 15 ft. at bottom, 14 ft. 6 in. at top, 153 ft. high.

Turbines. Main units, two G. E. turbines one 15,000 Kw. and one 10,000 Kw. voltage 13,200, 60 cycle, 3 phase.

Condensers. Surface condensers made by the Alberger Pump and Condenser Company.

15,000 Kw. turbine condenser has heads finished for a maximum surface of 23,900 sq. ft. and supplied with 18,000 sq. ft. of ¾-in. OD brass tubes.

10,000 Kw. turbine condenser has heads finished for 17,400 sq. ft. and supplied with 13,000 sq. ft. of ¾-in. OD brass tubes.

Boilers. 8—440 H. P. water tube B. & W. cross-drum boilers in service and 6—440 H. P. B. & W. boilers being installed. Boilers constructed for working pressure of 250 lbs. Two superheaters with each boiler to superheat steam from boiler 135 deg. F. above the temperature of saturated steam at 250 lbs. gauge pressure.

Stokers. Each boiler is equipped with one eight-retort Sanford-Riley underfeed stoker.

Draft Equipment. Balanced draft equipment supplied by The Engineer Company, New York.

Water Purification. Feed water is taken from Big Walnut Creek and purified by the lime-soda ash process.

Coal and Coal Handling Equipment. Fuel used is principally low grade Hocking nut pea and slack.

When the station is completed two 400-ton cylindrical steel coal bunkers will be provided just outside boiler room. Coal will be supplied to these bunkers by means of a flight conveyor through a coal crusher, thence by bucket elevators to top of coal bunkers. From the bunkers, coal will be carried into the boiler room by means of a 4½-ton electric coal larry which runs along the middle of the firing aisle so that stoker hoppers on each side may be fed. The coal bunkers, crusher and larry were furnished by the Jeffrey Mfg. Co.

The larry runs on a standard gauge track so that in case of a breakdown of the larry, or coal elevator to storage bin, a standard coal car can be run into the boiler room and unloaded by hand into hoppers.

Three or four months' supply of coal is provided by means of an elevated track extending over a coal storage space from which coal in cars is dumped. The coal is distributed over ground and reloaded into cars by means of a 15-ton Brown steam-driven locomotive crane provided with a 2-yard grab bucket.

A small steam locomotive is used for switching coal cars.

Ash Handling Equipment. Ash handling equipment consists of drag conveyors, cinder crusher and ash elevator manufactured by the Jeffrey Mfg. Co.

Auxiliaries. All auxiliaries are electrically driven except one Cam-

éron—4 stage boiler feed pump and two steam turbine driven Alberger AEG centrifugal vacuum pumps on main turbine.

There is a total of 61 auxiliary motors having a capacity of 1734 H. P. in service and 13 motors having a capacity of 740 H. P. to be installed.

Circulating Water Motors and Pumps. The circulating water for the condensers will be supplied by duplicate vertical shaft, adjustable speed, motor driven Wood circulating pumps. Three 120 H. P. motors are installed at present.

The pumps receive water from a gravity tunnel which runs under the entire length of the turbine room and after passing through condenser water discharges into a gravity tunnel which carries water out at a point 160 feet below intake.

Condensate Pumps. Each condenser is provided with duplicate motor driven single stage centrifugal Alberger condensate pumps.

Induced Draft Fans. Induced draft fans are located outdoors and 4 fans driven by 4—75 H. P. Lincoln motors are used for 8 boilers. Fans are made by The Green Fuel Economizer Co. and are capable of handling 7000 C. F. P. M. against 3½ inch static pressure when receiving gases from economizer at 450 deg. F. requiring 69 H. P. at fan shaft.

Forced Draft Fans. Four forced draft fans made by the Green Fuel Economizer Co. and capable of delivering 45,000 C. F. P. M. against 5½ inch static pressure when running at 846 R. P. M. are installed in boiler room basement.

Auxiliary Power Transformers. Two banks of 3—300 Kw. transformers 13,200 to 220/110 volt are in service.

Switchboard. Remote control, type H-3, 1200 amp. 15,000 volt oil switches manufactured by the General Electric Company located on main turbine room floor.

Outdoor Switching Equipment. Outdoor switching equipment on each 39,400 outgoing circuit consists of a 300 amp. suspension type choke coil, one 3 phase electrolytic lightning arrester, 3—300 amp. 45,000 volt disconnecting switches, one T. P. S. T. 50,000 volt, 300

amp. type AO-36 oil switch manufactured by General Electric Company, 3—300/5 amp. bushing type current transformer General Electric and 3 General Electric T. P. S. T. 300 amp. 45,000 volt LG 19 disconnecting switches.

Step-Up Transformers. Two 3 phase, 15,000 Kw. 13,200/39,400 volt step up, water cooled transformers. Another similar transformer to be installed as a spare.

Transmission Lines. 2—39,400 volt, 3 phase, 3 wire, 1/0 lines, 9 miles long to substation at Mound and Canal Streets.

1—39,400 volt, 3 phase, 3 wire, No. 4 line, 9 miles to Ralston substation (East Columbus).

1—13,200 volt, 3 phase, 3 wire, 1/0 line to Smoky Row Road Substation (South Columbus).

1—13,200 volt, 3 phase, 3 wire, 4/0 line to South Columbus under construction.

Oil Switch Operating Battery. Battery made by Electric Storage Battery Co. and consists of 60—E-5 exide elements in glass jars rated at 10 amp. for 125 volt service.

Acme Power Plant

Available power supply for Toledo and vicinity has been increased by the addition of a new power station built by the Acme Power Company which was started in operation March, 1918. The ultimate capacity of the station will be 200,000 Kw. of which the first unit, which is in operation at this time, comprises a 20,000 Kw. with building provisions for 70,000 Kw. and 11324 B. H. P. of which 5400 B. H. P. is in operation at present.

The building layout comprises three buildings; the Boiler and Turbine room occupying one building, the switch house and offices a second and the screen house a third.

Coal storage for the first unit consists of a dry pocket, which is installed below the track level, with a capacity of 2000 tons and spanned by an overhead traveling crane having a capacity for handling coal from dry pocket to crusher hopper of 180 tons per hour, two tracks serving the pocket for dumping coal from railroad cars to the pocket. Coal is then conveyed from the crusher or receiving hopper to fire bins

by a 24-inch Robbins belt conveyor with automatic weighing device and automatic distributor, to concrete bins of 1200 tons capacity designed to serve one double firing isle of eight boilers.

The plant is thoroughly equipped with metering equipment, both recording and indicating instruments, recording sufficient data for the calculation of the complete heat balance hourly.

Boilers are equipped with operator's control panel for complete control of stokers, fans, draft, etc., also with boiler meters, temperature recording instruments, CO_2 recorders, etc. To the above mentioned instruments, as well as to a system known as the daily unit data and cost system, we attribute very largely the economic operation of the station.

In each department of the station daily is kept a log sheet, varying only in some respects from the ordinary plant data sheet, which are gathered daily and summarized on a blank known as the general data sheet which is a summarization of the plant operation complete, a complete heat balance and a complete unit cost sheet which will be described later in the form of a paper on Daily Unit Data and Cost System as applied to Central Station Operation.

Mahoning and Shenango Railway and Light Company
Lowellville Plant

The Power Plant of the Mahoning and Shenango Railway and Light Company is located at Lowellville, Ohio. The plant is a modern one in every respect, and was built in the year 1911-1912. Addition of a 15,000 Kw. unit was made to the plant in 1914. A further addition of an additional 15,000 Kw. unit was completed in 1917. The plant now has a normal capacity of 45,000 Kw.

On the generating floor in the main engine room are two (2) 7500 Kw. maximum rating, horizontal General Electric A. C. 3 phase, 2300 volts, turbo-generators, and two (2) 15,000 Kw. maximum rating, horizontal General Electric A. C. 3 phase, 2300 volts, turbo-generators. The two (2) 7500 Kw. turbo-generators have a capacity of 7500 Kw. (each) continuously at 80% P. F., and the two (2) 15,000 Kw. turbo-generators have a capacity of 15,000 (each) continuously at 80% P. F. or higher.

The commercial efficiency of the two (2) 15,000 Kw. generators is as follows:

	100 P. F.	80 P. F.
¼ Load	90.6%	88.4%
½ Load	94.6%	93.4%
¾ Load	96.2%	95.0%
Full Load	96.6%	95.9%

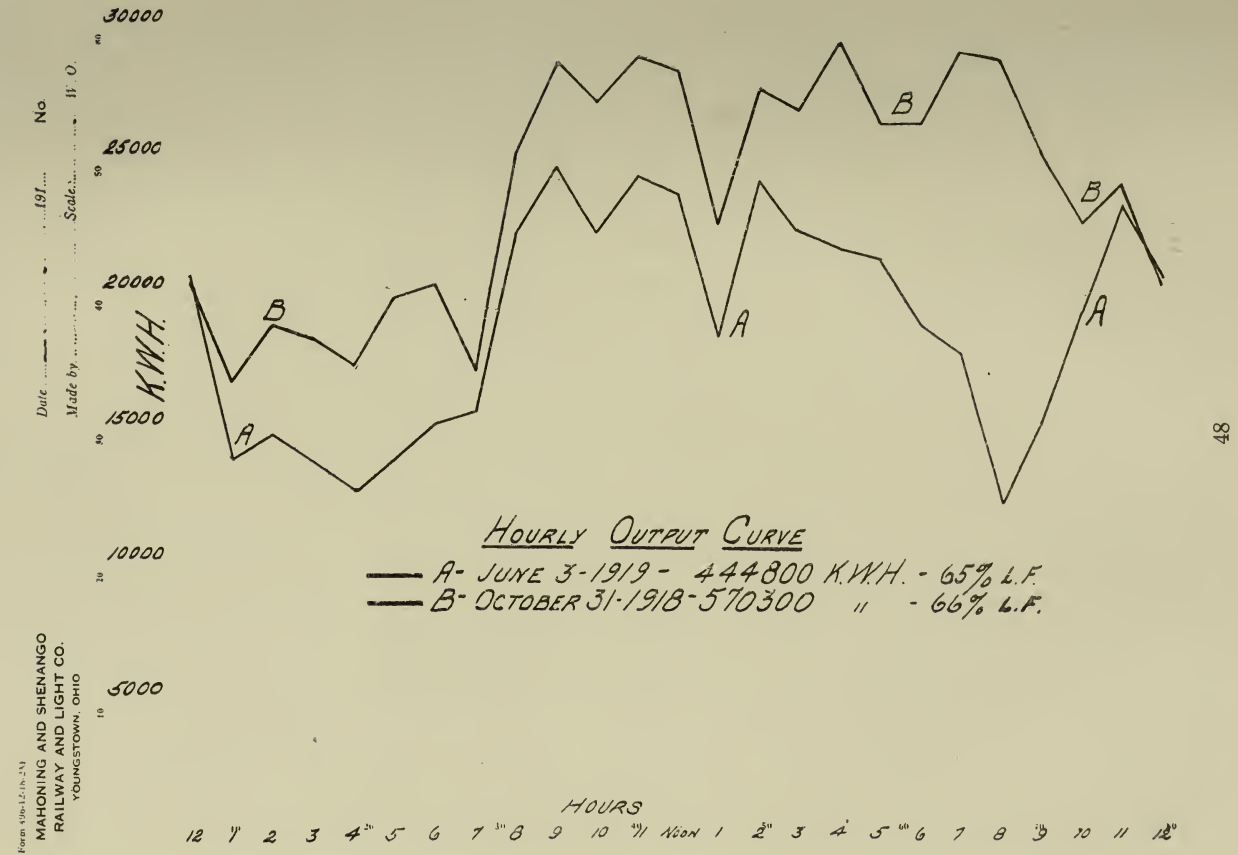
Each main generating unit is provided with independent auxiliaries, the auxiliaries for the two (2) 7500 Kw. generators being identical, also the auxiliaries for the two (2) 15,000 Kw. generators are identical. The auxiliaries for the 7500 Kw. and 15,000 Kw. generators will be taken up separately.

The two (2) 7500 Kw. turbines each exhaust into an Alberger Surface Condenser having a capacity of 22,500 square feet of cooling surface. These condensers are supplied with circulating water by two (2) 18,000 gallons per minute volute pumps built by the Alberger Condensing Company, being driven by a Skinner Horizontal Engine, 12½ inches by 15 inches. Each condenser to condense 136,500 lbs. of steam per hour and circulate at least 18,000 gallons per minute.

Connected to each surface condenser is an Alberger 4-inch two (2) stage centrifugal Hotwell Pump mounted on common base with a 15 H. P. General Electric 3 phase Induction Motor. Efficiency of pump, 40%. An Alberger Dry Vacuum Pump 12 inches by 30 inches by 4 inches is also connected to each condenser. This pump requires 1500 pounds steam at 502.5 deg. F.

The excitation is furnished by two (2) 125 Kw. General Electric Turbo Driven Exciters. The exciters are driven by a non-condensing General Electric Turbine (Curtis Type)—Maximum rating 250 B. H. P. Speed 2400 R. P. M., 175 pounds pressure at 125 deg. and 18 pounds back pressure. The generators are rated at 125 Kw., 125 volts, 1000 amperes. Overload rating—156.25 Kw. at rated voltage for two (2) hours.

The two (2) 15,000 Kw. turbines each exhaust into a Worthington Surface Condenser, having a capacity of 35,000 square feet of cooling surface. The condensers are supplied with circulating water by two (2) 30-inch class "B. S." double suction Worthington horizontal volute circulating pump each delivering 27,000 U. S. gallons per minute. These pumps are driven by a Terry Steam Turbine through Fawcus re-


Date ..... No.
Made by ..... Scale ..... H. O.
30000
25000
20000
15000
10000
5000
K.W.H.
A
B
HOURLY OUTPUT CURVE
A- JUNE 3-1919 - 444800 K.W.H. - 65% L.F.
B- OCTOBER 31-1918-570300 " - 66% L.F.
HOURS
12 1 2 3 4 5 6 7 8 9 10 11 NOON 1 2 3 4 5 6 7 8 9 10 11 12
MAHONING AND SHENANGO RAILWAY AND LIGHT CO.
YOUNGSTOWN, OHIO

ORGANIZATION CHART
LOWELLVILLE POWER HOUSE
MAHONING AND SHENANGO RY. AND LT CO
YOUNGSTOWN - OHIO
CHIEF ENGINEER
ASST. CHIEF ENGINEER
STORE KEEPER
CLERK
CLERKS
STATION OWNER
STATION ATTENDANTS
STEAM FITTERS
HELPERS
COAL ROOM FOREMAN
HELPERS
BOILER ROOM FOREMAN
BOILER ATTENDANTS
HELPERS
BOILER ROOM HELPERS
STATION ELECTRICIANS
HELPER
BOILER ATTENDANT
LOCOMOTIVE ENGINEER
YARD MASTER
ASH HOIST MAN
CRANEMAN
YARD FOREMAN
ASHMEN
COAL PASSER
SCALE SAMPLER ATTENDANT
PULLEYMEN
CRUSHER ATTENDANT
SWITCHMAN
MATRON
ENGINEERS
FOREMAN STORE ROOM
STORE MECHANICS
HELPERS
SUBSTATION ATTENDANT
SWITCHBOARD OPERATORS
PUMP ENGINEER
OILERS
WATER TENDERS
TRAINERS
CRANE FOREMEN
CRANE ROOM HELPERS
BOILER ROOM HELPERS

ducing gears. Each condenser to condense 200,000 pounds of steam per hour and circulate at least 27,000 gallons of water per minute. A Laidlow, Dunn, Gordon Rotating Dry Vacuum pump 13 inches by 35 inches by 30 inches single cylinder, double acting is used in connection with each condenser.

Connected to each condenser are two (2) 4-inch Hotwell Pumps—one driven by a Terry Steam Turbine whose maximum steam consumption is 1300 pounds per hour, the other being driven by a 25 H. P. 1800 R. P. M. synchronous speed General Electric Motor. Each pump has a capacity for delivering 250,000 pounds of steam per hour against a head of 45 feet.

The excitation for the two (2) 15,000 Kw. generators is furnished by two 200 Kw. combination turbine and motor driven exciters. A Terry Turbine type "C" non-condensing, single stage is direct connected to a 200 Kw. General Electric Motor Generator, whose highest efficiency rating is 300 H. P. Speed 1200 R. P. M., 175 pounds, 502.50 steam 18 pounds per B. H. P. The motor is of the General Electric make, type "I" form "K" squirrel cage, 6 poles, 60 cycles, 2300 volts. The generator is rated at 200 Kw., 125 volts, 1600 amperes, with an overload capacity for 250 Kw. at rated voltage for two (2) hours. The units are arranged with the generator between turbine and motor so that either drive may be used alone to run generator. The motor ordinarily carries the load with the turbine governor so adjusted that the turbine will automatically take up the entire load in case of failure in the motor circuit. The boiler room contains nine (9) 600 H. P. Edge Moor Water Tube Boilers and fifteen (15) 600 H. P. Babcock and Wilcox Water Tubes Boilers, all equipped with Foster Superheaters and Taylor Underfed Stokers. All boilers are arranged in batteries of two (2). Boilers are allowed a steam pressure of 200 pounds per square inch with a superheat of approximately 150 deg. F.

There is also contained in boiler room one (1) 10,000 H. P. and one (1) 15,000 H. P. Hoppes Feed Water Heater, horizontal open type. The former has a capacity of 300,000 pounds of water per hour, the latter 450,000 pounds of water per hour.

Seven (7) retort Taylor Underfed Stokers are used on all boilers. The guaranteed efficiency on combined boilers and furnaces are as follows: When operating at 200% normal rating the combined boiler and furnace efficiency shall be not less than 70% and at any point between

100% of normal boiler rating and 125% normal boiler rating, the combined boiler and furnace efficiency shall not be less than 75%.

The Taylor Underfed Stokers are operated by six (6) American Blowers Company Vertical Engines which are connected by chain drive to a line shaft and from line shaft to stoker shaft.

The boilers are supplied by the following feed pumps: One (1) 1000 gals,. 3 stage, Lee Courtney Centrifugal Feed Pump driven by a 240 H. P. Terry Turbine, one (1) 1000 gals., 3 stage, Janesville Double Suction Turbine Pump driven by a 180 H. P. Terry Turbine. Both pumps to deliver 1000 G. P. M. at 212 deg. against a total pressure of 225 pounds with at least 10 feet head on suction. Pump efficiencies 62%.

There is also used two (2) 500 gals., 3 stage, Janesville Double Suction Turbine, pumps driven by a 110 H. P. Terry Turbine with a capacity of 600 G. P. M.

Connected to an air duct running lengthwise underneath the boiler room floor which supplies air to the Taylor Underfed Stokers are two (2) American Blower Fans each connected to a Skinner Engine having a capacity of 60,000 cubic feet per minute against a working pressure of 5¾ inches water. Also there is in service one (1) American Blower Fan direct connected to an American Blower Double Engine. This fan has a capacity of 66,000 cubic feet per minute against a pressure of 5¾ inches of water and one (1) Buffalo Forge Company Fan of 120,000 cubic feet per minute capacity, driven by a Terry Turbine, type "G" non-condensing, single stage. Turbine speed to be 3200 R. P. M., 200 H. P., water rate 6,800 pounds with steam at 200 pounds pressure 125 deg. F. steam and 18 pounds per B. H. P. Both fans supply air to stoker.

On the main floor is the switchboard apparatus consisting of nineteen (19) 16-inch panels of black slate mounted on pipe frame work. On this switchboard are mounted the various instruments, relays and switches for connecting the high tension feeder circuits, also the Tirrill Regulators. Facing this board is a seven (7) panel bench board on which is mounted various instruments for controlling the generators, exciters and storage batteries.

The transformation of current is taken care of by five (5) banks of transformers, consisting of three (3) transformers each, two (2) banks being located in separate cells within the station, the other three (3)

LIBRARY
UNIVERSITY OF ILLINOIS

banks being located outside of the station. Transformers are of the General Electric and Westinghouse make 3125 K. V. A. each, feeding two sets of transmission system—one 22,000 volts, the other 66,000 volts.

The operating force consists of approximately 75 men, the maintenance force 46 men, and the electrical force 3 men.

Water is taken from the Mahoning River at an average temperature of 50 deg. F. during the winter months and 100 deg. F. during the summer months. The water as taken from the river for purification purposes in the Scaife System is first pumped through two (2) Horizontal Steel Pressure Filters having a combined capacity of 60,000 gals. of water per hour. The filtering material consists of three (3) grades of filter sand (98% Silica) specially graded for the purpose, supported by a layer of washed and graded gravel. From the filter tank the water is used throughout the station for cooling jackets, transformers, etc.

After serving this purpose it is again returned to the Scaife Water Softening and Purifying System for purification. This system has a capacity of 16,000 U. S. gallons per hour delivering the water for boiler purposes, *clear* and free from *turbidity*.

Circulating water is taken direct from the river, and because of the large amount of solid matter contained in it, it is necessary to clean condensers twice a week. A vacuum of 28 inches to 29 inches is obtained in the winter months and 26 inches and 27.5 inches in the summer months. Coal consumption is less than 2 pounds per Kw. and an overall average of 16 pounds of steam is used per Kw. H.

Average Coal Analysis.

Moisture	1.40%
Ash	9.35%
Volatile	37.85%
Fixed Carbon	51.40%
Sulphur	2.41%
B. T. U.	13,000

A Brief Description of the Miller's Ford Station of The Dayton Power and Light Co.

The present installation consists of two 12,500 Kw. G. E. Turbo-Generators with two 15,000 sq. ft. Westinghouse surface condensers

and three 1373 H. P. Babcock & Wilcox cross drum boilers equipped with 14 retort Taylor Stokers. The boilers operate at 225 lbs. pressure and 125 deg. F. superheat. No economizers are installed and the auxiliary drives are mixed steam and electric so divided that a heat balance can be maintained at all loads. While the makeup is less than 5% it is treated in a Vater hot process water softener assuring no tube trouble due to operating the boilers at high ratings.

The coal handling system is extremely simple, the coal is dumped from the cars or taken from storage by means of a McMyler-Interstate locomotive crane to the coal pit and hoisted by means of a steam-operated hoisting engine and a clam shell bucket to a hopper above the bunker, from there is passes through a crusher thence into cable car when it is weighed on platform scales and then distributed into the bunker.

The ashes are dumped into hoppers and then discharged into 1½ yard cars which are hauled by a gasoline locomotive to parts of the property which are being filled in.

Bailey Boiler Meters and Foxboro-Heath CO_2 recorders are installed on all boilers. Meters are also installed in steam leads to turbines, the feed water line and for measuring the makeup and blow down. The data is worked out each day getting all results of the previous day's operation by noon. The present overall thermal efficiency is 15 per cent.

The committee wishes to express its deep appreciation of the interest manifested in its work by the members of the Association and of the splendid support which it has received.

Respectfully submitted,

HENRY B. DATES, *Chairman.*
WILLIAM LONG,
R. J. FEATHER,
R. G. SLOAT,
W. H. BROMLEY,
W. H. ALDRICH,
C. H. SPIEHLER,
C. W. DEFOREST,
S. M. RUST,

Committee.

Secretary Gaskill: Professor Dates wrote me that he desired the paper by Mr. Strike to follow the Report of the Station Operating Committee, and I have so scheduled it upon the program. I do not know whether you desire to discuss the Station Operating Committee's Report before you take up Mr. Strike's paper, or whether you wish to have Mr. Strike's paper before taking up the general discussion. Which do you want?

A Voice: Let us have Mr. Strike's paper.

The paper was read by Mr. C. E. Lewis, as follows:

DAILY UNIT DATA AND COST SYSTEM AS APPLIED TO CENTRAL STATION MANAGEMENT

By J. M. Strike, Acme Power Co., Toledo, Ohio

Almost from the beginning of Central Station operation we have felt the need of a more direct method of bringing before the station Superintendent or Manager daily the actual data and cost of operating each individual department or sub-department, and in an aggregated sum to finally arrive at the actual efficiency and cost per unit of finished product of manufacturing plant or station. From an efficiency standpoint this probably has been felt more deeply than any other for this reason, that for a great many years, and even at this time, some of the large Central Stations are being operated with a switchboard efficiency as low as 9 or 10½ thermal efficiency, many of them with an equipment that should be doing the same work with an efficiency of better than 14%. In order that the station as a unit may be operated and be made to deliver its finished production at its maximum rate of efficiency, it is necessary for the Superintendent or Manager to be able to point out to the operating department the weak places which are not operating at the maximum rate of efficiency. This data should be gathered and complete balance of the station performance kept daily, which means collecting by the operating department data of operating units hourly that their results may be set up in proper form each day for comparison. Such a system would seem to be a long and laborious task as well as carrying considerable investment of metering instruments to obtain data of operating performance. Such a system has been attempted only

by a very few of the larger central station operators at this time. Some of our seemingly more modern stations are not in a position to arrive at total production cost per unit of output daily, or even to strike a heat balance on the station until the general books are closed at the end of the month and after all invoices and bills are in and a balance declared by the Auditing Department. Such information comes to the head of the station management from 10 to 15 days after the previous month is closed, he just to find that the plant has been operating all this period of time at a very heavy loss, and after such information has reached him, it is only in a general form and he has yet to guess at which department or individual unit has been operating at a loss. He may only guess at the losses up the smokestack, to the ash pits, or out in the circulating water or inefficient management of the plant in the way of supplies, labor, etc.

The writer during the past five years has given this one phase of power plant management more thought and attention than probably any other in connection with the efficiency operation of power stations, and, in his opinion, is the keynote of the results or efficiency work as connected with the steam generation of electrical power, and the proper solution of this problem seemed for a time almost prohibited, due to the cost of an additional auditing department and system which was believed would be necessary to accomplish the true analysis of the operating cost and set them up in a manner that they would be of the most value to the operating head of the department. There has been various systems of collecting operating data and power station accounting attempted by some of the larger central station operators. However, probably no other company has attempted to adopt so thorough a system of power plant accounting than that of the new Acme Power Company's station in East Toledo, Ohio, which has a daily unit data and cost system. This system has been in operation since the plant was started a year ago and is proving very satisfactory and serving the purpose of placing before the station manager daily in full detail operating performances of every unit connected with the electrical generation of power and with it the cost of efficient production per unit of output of each individual unit and subdivision of the station, which you will note from the following detailed description, and closing the last item with the total production cost per net kilowatt hour generation of the station.

The system complete consists of 11 forms or sheets, 7 of which are

detail data sheets which are filled out by the operators in charge hourly and returned to the office at the end of the 24-hour day, and contain full detail operating data for the unit to which it belongs, beginning with the fuel entering the plant, a data sheet on which is kept a complete record of coal entering the yard in pounds by car number and initial, cars unloaded in dry pocket or storage, coal delivered to the boiler department in firing bins in pounds, coal remaining in stock unconsumed for the day and month in total number of pounds. Entering the boiler room, we find a data sheet for each boiler in service on which is recorded, hourly, coal received and consumed from the firing bins together with all operating data, such as steam pressure and temperature; furnace performances, such as draft, air pressure and flue gas temperature, all recorded by the hour and total for the day. With this data sheet comes the daily recording charts from instruments in the boiler department, such as boiler steam flow meters and steam flow in pounds per hour, air flow through the furnace, stokers, speed from which coal consumed is calculated, wind box pressure under the fire, draft conditions over the fire, flue gas temperature, temperature and quality of steam generated, and per cent CO_2. Another data sheet in the boiler department is that of the Heater and Pump room, containing data on water fed to the boilers, temperatures, and pounds per hour of condensate returns from prime mover or engine room, temperature and in pounds per hour of make-up water as supplied from treating plant, total amounts and temperatures of water fed to boilers, all measured up by "V" notch meters on recording charts, also amount of exhaust steam used in heating feed water, total of all quantities for the 24-hour day. Another data sheet of this department is one for the treating plant, treating make-up water for use in the boiler department, containing number of pounds of water treated, constituency of water before and after treating in grains of harness per gallon, together with amount of chemicals used in the treating process. Data gathered on these four sheets together with the recording instrument charts are accomplished in calculating the total input and output of the boiler department, both in quantities and rate of efficiency which are carried forward on another form of general data sheet which will be explained in another paragraph of this paper. Together with the operating data which is recorded on all data sheets, provisions are made for reporting

all maintenance work, materials and labor for the day as well as a large space for general remarks.

Entering the prime mover, or engine room, the data sheet is very much like the one described for the boiler department, containing only the total operating data of the turbine and generator in total pounds of steam used per hour, weights, temperatures and quantity, condensor performance, efficiency of condensating equipment, also turbine and generator efficiency. These items are reported hourly and total amounts for the 24-hour day.

In the switching room is another data sheet containing data relative to power generated hourly, data as to the load of station and feeders, power generated, both gross and net, total output in kilowatt hours and a total for the day, together with amount used in the plant as station power and lighting. Accompanying this sheet is another for storage battery, containing total data of battery performance for the day.

Each of the above mentioned data sheets are collected and returned to the desk of the plant Chief Engineer for his approval, then to the Results Department to be checked and totalled and the general data entered on another form, or general data sheet which is a summary sheet carrying total amounts on the complete plant performance in amounts and percent of efficiency of the plant in general, both for the day and month and same day and month last year and percent of increase or decrease for same day and month over that of last year. Reported on this sheet is a complete heat balance of the station, and by careful study of data contained, the station manager is able to correct any one item of plant operation before it amounts to a very large sum of money lost.

The unit data or general data sheet being completed, the next step is that of the unit cost. Total quantities of input in money and total amount of output per kilowatt hours are taken on to another sheet which is the unit cost sheet. With this data comes from the timekeeper's desk a daily time distribution form bearing the name and number of every one working in the production department. Laid out on this report is a column for every operating and maintenance account as set up in the company's classification of production operating accounts. Each employee's time is distributed from and amounts as reported on the daily time cards which are turned in by each individual employee and is distributed both in hours and money to each classifica-

tion and is totalled both in hours and money, and these amounts are taken on the unit cost sheet, which is set up in classifications as will be described later. The daily time sheet not only shows the total daily time in hours and money, but shows at a glance if any one classification is being charged too heavily or if the department is exceeding the labor cost previously estimated to be expended, and is a good guide to the station manager.

Another important part of the system is that of the stock record. In conducting a cost system it is very necessary to keep a very close account of materials in stock as all purchase requisitions for material used, or expected to be used, in the operation of the plant are charged to stock, including coal, and in fact every article purchased goes through the stock records and a stock requisition is issued when anything is taken from the stock room and charged to the operating account for which the article was used. This requisition, after being properly signed, is passed through the stock records and priced and credited to the account against which it was charged at the time of entering stock. This shop requisition then passes on to the unit cost blank where it is entered into the operating classification of the station.

Now the three sheets which carry the data to make up the unit cost sheet are, first, the general data sheet; second, the time distribution sheet, and third, the shop requisitions. The unit cost sheet is divided into classified divisions between operation and maintenance for the boiler department; operation and maintenance of steam generating department; total operation; total maintenance; total production, and numerous other items, such as total maintenance per kilowatt hour generator; total generating cost per kilowatt hour; boiler maintenance per ton of coal firing, cost per 1000 pounds of steam generated. In fact, every item of operation and maintenance is audited on this sheet which has to do with the production department. The general and office expense, interest and taxes, obsolesence, gross and net earnings of the company are not included on this sheet. There are about 90 items which are of vital importance to the operation of the station which are taken into account and reported daily and for the month on this daily unit cost sheet.

The three data sheets, unit cost sheet, time distribution sheet and general data sheet come last to the station manager, and places before him a quick review of the operation of the station from a total and de-

tailed operation of the property. The above mentioned system is operated at a surprisingly low cost. At the time the system was started, it was thought the cost would be too great to continue, but after it was set into operation in the office of the plant superintendent, it required the services of three clerks and after six months of operation, two were able to handle the work, and later it was removed to the offices of the general bookkeeping department and the service of one clerk is the only extra cost to the bookkeeping department which is required to operate this system. The system was designed to fit into the general scheme of bookkeeping necessary to carry on the general accounting of the Company and is a splendid check to the bookkeeping department, and we find the accuracy of the system checks with the reports which are sent out each month and are drawn from the general books of the company. We would not attempt to estimate the value of this system of accounting to the operation of the station, although we do know that the operating efficiency obtained in the new station in East Toledo is attributed very largely to the fact that it is possible at all times to arrive at the actual rate of efficiency that each unit is delivering its work and the cost of same in money per unit of plant output. If the overall efficiency of the station varies 1% from day to day the reason for same is very closely detected, and at a glance, by consulting the general data sheet for the day in question.

It is fair to the operating men that they should know at all times at what rate of efficiency they are operating the company's property, and it is just as necessary for the power plant to be able to balance their day's work as it is for any other business man or banker to balance his day's work.

ACME POWER CO.

DAILY COST SHEET

FORM OPR 806

DATE 19

	CORRESPONDING DAY OF WEEK			THIS MONTH TO DATE		
	THIS YEAR	LAST YEAR	INCREASE DECREASE	THIS YEAR	LAST YEAR	INCREASE DECREASE
BOILER MAINTENANCE						
Boiler Room Maintenance, Material						
Boiler Room Maintenance Labor						
Boiler Cleaning, Labor						
Boiler Room Auxiliary Main. Material						
Boiler Room Auxiliary Main. Labor						
Miscellaneous Repairs, Material						
Miscellaneous Repairs Labor						
Water Softener Main. Material						
Water Softener Main. Labor						
Coal Handling Mach. Main. Material						
Coal Handling Mach. Main. Labor						
Ash Handling Mach. Main. Material						
Ash Handling Mach. Main. Labor						
Total Boiler Maintenance						
BOILER OPERATION						
Coal (Initial Cost)						
Coal (Freight)						
Coal (Unloading)						
Coal (Handling)						
Coal (Fuel Cost)						
Less Cinder Credit						
Net Cost Boiler Fuel						
Water Softener Labor						
Water Softener Chemicals						
Water Softener Sundries and Supplies						
City Water						
Boiler Room Labor						
Boiler Room Sundries and Supplies						
Ash Handling Machinery, Labor						
Ash Handling Mach. Sundries and Sup.						
Total Boiler Operation						
Cost of Coal per 1000 lbs. Water Evap.						
Cost of Coal per Million B T U (Ash pt.						
Boiler Main and Labor per ton of Coal						
Plant Main and Labor, per ton of Coal						
Cost of Coal to Total Produc'n Cost %						
Cost of Coal Less Cinder Credit per net K W H						
Cost of Steam Production per net K W H						
Cost of Generation per net K W H.						
Cost of City Water per net K W H.						

	CORRESPONDING DAY OF WEEK			THIS MONTH TO DATE		
	THIS YEAR	LAST YEAR	INCREASE DECREASE	THIS YEAR	LAST YEAR	INCREASE DECREASE
GENERATOR ROOM MAINTENANCE						
Turbine Maintenance, Material						
Turbine Maintenance, Labor						
Condenser Cleaning, Labor						
Turbine Auxiliary Main., Material						
Turbine Auxiliary Main., Labor						
Screenhouse Main., Material						
Screenhouse Main., Labor						
Switchhouse Main., Material						
Switchhouse Main., Labor						
Electric Repair Dept., Material						
Electric Repair Dept., Labor						
Machine Shop Main., Material						
Machine Shop Main., Labor						
Miscellaneous Repairs, Material						
Miscellaneous Repairs, Labor						
Total Generator Room Maintenance						
GENERATOR ROOM OPERATION						
Turbine House Labor						
Turbine House Sundries and Supplies						
Screenhouse Labor						
Screenhouse Sundries and Supplies						
Switchhouse, Labor						
Switchhouse Sundries and Supplies						
Miscellaneous Labor						
Miscellaneous Sundries and Supplies						
Total Generator Room Operation						
Total Boiler Operation						
Operation, Steam Power Generation						
Operation, Steam Power Generation						
Superintendence						
Total Production Cost						
Cost of Treating Water per Net K W H.						
Total Cost of Water per Net K W H.						
Machine Shop Expenses per Net K W H						
Elec. Repair Dept per Net K W H						
Superintendence per Net K W H.						
Labor per Net K W H						
Sundries and Supplies per Net K W H.						
Repairs per Net K W H.						
Total Production Cost per Net K W H						

ACME POWER CO.

GENERAL DATA

AVER BAR — Dep 29.47 — 28.44 — .003

DATE — June 20th, 19[illegible]

	CORRESPONDING DAY OF WEEK				THIS MONTH TO DATE			
	THIS YEAR	LAST YEAR	INCREASE	DECREASE	THIS YEAR	LAST YEAR	INCREASE	DECREASE
Gen. K.W.H. Gen No 1 Turbine	266,000	183,000	77,000		3,912,000	3,245,000	667,000	
Percent Total Generation	100	100			100	100	0	
Hours run	24	24			390.67	385.24	5.43	
Load Factor	55.4	37.9			50.1	42.15	7.95	
Gen K.W.H. Gen No 2 Turbine								
Percent Total Generation								
Hours run								
Load Factor								
Gen K.W. Gen No 3 Turbine								
Percent Total Generation								
Hours Run								
Load Factor								
Gross Generation	266,000	183,000	77,000		3,912,000	3,245,000	667,000	
Station Power	3,000	8,600		5,600	51,000	147,400		96,400
Net Generation	263,000	180,400	82,600		3,861,000	3,097,600	763,400	
Used for Station Lighting	1,000	1,000	0		17,000	17,000	0	
Net Energy Output	262,000	179,400	82,600		3,844,000	3,080,600	763,400	
K.W. Station Demand	17,000	11,000	6,000		17,000	13,500	3,500	
Engine Load Factor	64.2	68.0		3.8	57.15	57.2		.125
Pounds City Water	0	0	0		0	367,050		367,050
Pounds Make Up Water	250,000	250,000	0		5,420,000	10,324,000		4,904,000
Pounds Condensate Returns	3,300,000	2,320,000	980,000		43,320,000	40,540,000	2,780,000	
Total Boiler Feed Water	3,787,500	3,177,500	610,000		58,880,000	56,504,500	2,375,500	
Pounds Water Steam-Down	23,000	47,600		24,600	723,000	904,855		181,855
Pounds Water Evaporated	3,764,500	3,129,700	634,800		58,157,000	55,599,645	2,557,355	
Pounds Water per Net K.W.H.	14.31	17.34		3.03	15.05	17.97		2.92
Lbs Boiler Pressure	227.9	229.16		1.26	230.9	228.4	2.5	
Lbs Feed Water Pressure	276.0	280.16		4.16	274.1	270.2	3.9	
Lbs Feed Water Temp to Heaters	96.3	87.50	.88		90.4	92.75		2.35
Lbs Feed Water Temp to Heat.	193.5	180.50	13.0		197.6	187.8	9.8	
Lbs Temp Rise	103.2	93.00	10.2		107.2	95.05	12.15	
Lbs Temp to Economizers								
Lbs Temp from Economizers								
Lbs Temp Rise								
Coal Put in Wet Bunker on Date								
Coal from Wet Pile to Dry Pile								
Put in Wet Bunker End of Day								
Coal Taken in Dry Bunker Date								
Total Coal in Dry Bunker	0	0	0		5,827,700	5,558,500	269,200	
Pounds of Coal Used	5,033,365	408,000	4631,363		3,033,363	408,000	4,631,363	
Lbs of Water Evap per Lb Coal	536,880	376,750	160,130		8,167,285	7,102,030	1,063,255	
Lbs Coal per Gross K.W.H.	7.02	7.6		.58	7.12	7.84		0.72
Lbs Coal per Net K.W.H.	2.020	1.972	0.028		2.070	2.185		0.076
Lbs Coal per Net K.W.H.	2.043	2.085		0.042	2.118	2.297		0.179
B.T.U. Input to Boiler (Millions)	6,500	4,282	2,218		93,300	84,000	15,900	
B.T.U. per Gross K.W.H.	24,750	22,630	1,820		25,530	25,850		320
B.T.U. per Net K.W.H.	24,750	23,710	1,040		25,880	27,150		1,270
Boiler Plant Efficiency	69.7	70.2		5.5	69.3	72.5		7.6
Equiv. Evap.—Therm. Eff.	13.74	14.31		0.57	13.15	12.5	0.65	
Gross B.T.U. per lb. of Coal	12102	11,372	730		12,222	11,820	402	
Per Cent Combustible Ash	16.31				15.77			

Turbine No	Water Rate	Temp Inj Water	Temp Disch Water	Temp Cond Water	Temp Exh Steam	Vacuum Refer to 30" Bar	Deg of Superheat
1 Day	12.41 - 12.27	82.65 - 73.83	83.48 - 83.62	90.5 - 82.37	95 - 85.87	28.39 - 28.71	143.6 - 84.05
2 Mo	12.60	78.18	84.12	84.77	90.21	28.59	134.0 - 73.1
3							

NOTES — CARS COAL RECEIVED — CARS COAL SAMPLED — KIND OF COAL — ASH PIT SAMPLED

	Day				Month			
	This Year	Last Year	Increase	Decrease	This Year	Last Year	Increase	Decrease
Make Up less Blow Down	227,000				4,637,000			
% of Feed Make Up to Evap	6.035				8.075			
Boiler Test	5.770				7.750			
Lbs of Avr. Steam	316,000	591,500		275,500	5,048,000			
Water Rate, M.E. per set K.W.H.	1.202	3.13		1.928	1.307			
Condensate Temp Leaving Pump	13.00	11.6	1.40		12.59			
Temp rise in Condenser	92.00				87.16			
Temp rise in Engineers	1.50				2.17			
Exhaust Steam Condition (Jet)	4.50				5.22			
(Surface)	3.00				3.05			
	12.35				12.03			
Vacuum at Diff Inj	2.02				0.87			
Temp rise in Circ water	5.83				5.94			
Eff.	12.6				10.16			
Connected Boiler, H.P. Hrs	82,500				1,245,750			
Installed	16,500				308,750			
Connected Turbine, K.W.H.	480,000				7,710,000			
Measurements for Losses per set K.W.H.	0.598				0.973			
Overall Thermal Eff (Meals Sys.)	21.40				21.17			
Station Demand per Hour	68.0				85.0			
Net Content of Coal	10.59				11.03			
% of Moisture in Coal	6.73				7.59			
Vacuum Temp at Turbine	542				531.5			
Exhaust Steam Temp.	232.7				236.7			

ACME POWER CO.

FORM OPR 204

SWITCH HOUSE REPORT

DATE June 20 1913

	TIME	12M	1AM	2	3	4	5	6	7	8	9	10	11	12N	1PM	2	3	4	5	6	7	8	9	10	11
GENERATOR NO 1	VOLTS	6600	6600	6600	6600	6600	6600	6650	6650	6650	6670	6700	6700	6700	6700	6700	6700	6650	6650	6650	6650	6650	6650	6650	6650
	AMPERES	800	680	620	600	600	520	700	1040	1440	1460	1180	1380	1440	1440	1460	1480	1480	1140	980	740	800	1040	980	860
	K W. LOAD	7000	6500	6000	5500	4500	7500	11500	16000	16000	16500	16000	12500	14000	15000	16000	15500	16000	12000	10000	6300	8500	11500	10000	9000
	EXC VOLTAGE	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
	AMPERAGE	220	200	200	200	200	200	200	240	270	270	270	240	260	250	285	270	260	250	240	220	220	245	240	230
	POWER FACTOR	84	87	80	80	80	80	85	85	86	87	88	88	80	82	88	90	90	85	82	73	76	87	82	80
	Deg Centigrade	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
GENERATOR NO 2	VOLTS	64	63	63	61	60	60	60	64	70	74	75	70	70	74	74	74	74	70	66	63	64	65	67	65
	AMPERES																								
	K W LOAD																								
	EXC VOLTAGE																								
	AMPERAGE																								
	POWER FACTOR																								
	FREQUENCY																								
GENERATOR NO 3	VOLTS																								
	AMPERES																								
	K W LOAD																								
	EXC. VOLTAGE																								
	AMPERAGE																								
	POWER FACTOR																								
	FREQUENCY																								
TRANSFORMERS	BANK A. TRANSF NO 1 TEMP.	47	48	47	45	45	45	45	48	51	51	54	55	57	57	56	56	54	57						
	NO 1 AMP.																								
	NO 2 TEMP.	47	47	46	45	45	44	44	45	54	54	54	54	56	57	55	57	58	58						
	NO 2 AMP																								
	NO 3 TEMP	47	47	46	45	45	44	44	46	54	51	54	54	56	56	55	57	57	57						
	NO 3 AMP																								
	B NO. 1 TEMP.																								
	NO 1 AMP																								
	NO 2 TEMP																								
	NO 2 AMP.																								
	NO 3 TEMP.																								
	NO 3 AMP																								
	C NO 1 TEMP.																								
	NO 1 AMP.																								
	NO 2 TEMP																								
	NO 2 AMP																								
	NO 3 TEMP																								
	NO 3 AMP																								
FEEDERS	FEEDER NO 1 AMPS	40	20	20	20	20	20	20	30	90	90	98	90	64	88	90	90	90	68	55	40	40	60	55	40
	NO 2	40	20	20	20	20	20	20	30	90	88	98	90	64	88	90	90	90	66	55	40	40	60	55	40
	NO 3	40	20	20	20	20	20	20	30	80	80	88	86	62	80	84	84	84	64	55	40	40	60	55	40
	NO. 4	40	20	20	20	20	20	20	30	80	80	88	86	60	80	84	84	84	62	50	40	40	60	50	40
	NO. 5																								
	NO 6																								
	NO 7																								
	NO 8																								
	NO 9																								
	NO 10																								
	NO 11																								
	NO 12																								
	STATION DEMAND																								

K W H METERS		CONSTANT	TODAYS READING	YESTERDAYS READING	KILOWATT HOURS	METER CHECKED
	NO 1 GENERATOR GROSS	1000	81830	81564	266	12:00 M.
	NO 2 " "					
	NO 3 " "			80079		
	NO 1 " NET OUTPUT	1000	80341		262	
	NO 2 " "					
	NO 3 " "					
	STATION POWER & LIGHTING		1489	1485	4	
	ELECT EXCITER POWER A.C.					
	" " OUTPUT D.C.					
	STEAM					

INSPECTED OIL SWITCHES

CHARGED LIGHTNING ARRESTERS. NO. 15, 16, 17, 18, E. S. Sub. at 1:35 PM

Started to charge batteries at 2:44

Peak Load 9000 K.Wat 12^00 Peak Load 16500 at 9:00 AM. Water St. #2 off line at 4:20 PM

Batteries off charge at 3:15 PM

Peak Load 17000 K.W at 5:30 PM.

C. Tamlyn 11 PM-7 AM OPERATOR John Dusseau 7 AM-3 PM OPERATOR D L. Veliquett 3 PM-11 PM OPERATOR.

FORM OPR 207

ACME POWER CO.

COAL POCKET LOG SHEET

DATE June 18, 1919.

CAR REPORT

CARS ON HAND	WTS ON HAND	CARS RECEIVED	WTS RECEIVED	CARS UNLOADED	WTS. UNLOADED
TOC 25761	98500	BRP 40093	98800	TOC 25761	98500
		BO 225057	101200	BO 225057	101200
		HV 21540	107900	BRP 40093	98800
				HV 25761	107900

TOTAL WT. | TOTAL WT. | TOTAL WT. 406400

COAL POCKET REPORT

WET POCKET	
Coal in Wet Pocket to Date	
Coal Put in Wet Pocket on Date	
Total Coal in Wet Pocket	
Coal from Wet Pocket to Dry Pocket	
Balance in Wet Pocket End of Day	
DRY POCKET	
Coal in Dry Pocket to Date	6046963
Coal Put in Dry Pocket on Date	406400
Coal from Wet Pocket to Dry Pocket	
Total Coal in Dry Pocket	6453363
Weightometer Reading Yesterday	79630
" " Today	79896
" Constant	2,000
Coal Put in Bunkers	532000
Balance in Dry Pocket End of Day	5921363
Total Coal on Hand	8822433
No. of Cars on Hand End of Day	0
" " Received	3
" " Unloaded	4
Cranes Inspected by	
Crusher Inspected by	
Conveyor Inspected by	
Bal Coal in Bunkers to date	2873790
" " put in " on date	532000
Coal used from Bunker on date	504720
Bal coal in Bunker end of day	2901070
Total Coal used to date	7124245
" " put in dry pocket	5827700
" " " Bunkers	7242000

Not to date

REMARKS:-

Note any trouble or repairs on coal handling machinery.

Acme Storage 2602700#

Acct 300 A.
To date 172000#

Acct 300 B
To date 60000#

ACME POWER CO

FORM OPR 404

NO. 1. TURBINE REPORT

WEATHER [illegible]

DATE [illegible] 1915

TURBINE WATER RATE

AIR WASH TEMP.

	IDEAL WORKING CONDITION	12 M	1 AM	2	3	4	5	6	7	8	9	10	11	12 N	1 PM	2	3	4	5	6	7	8	9	10	11	TIME	WATTHOUR READING	K W H	STEAM FLOW METER	STEAM PER K W H	CIRC. WATER PER K W H	CIRC. WATER INLET	CIRC. WATER OUTLET
Ind. K W Load		7870	6500	6400	6100	5900	4500	7500	7500	7500	16500	16500	16500	16500	16500	16500	16500	16500	16500	16500	16500	7450	7450	7000	12 M	8/5664	8000	336 6	[illegible]	[illegible]	[illegible]	[illegible]
Water Temp Cond. less Heater		42	41	41	40	41	38	40	41	46	47	47	47	47	46	47	48	48	49	49	52	54	54	54	52	1 AM	8/5712	8000	336 4	10.1990	13 99	42	42 100
" " enter "		88	87	87	86	86	85	87	87	87	84	84	85	85	84	84	84	84	85	85	85	85	90	91	89	2	8/5778	6000	337 1	14 [illegible]	11 [illegible]	41	41 99
Temperature Rise		4	3	4	4	3	3	3	2	2	3	2	2	3	3	3	3	3	3	2	4	4	5	4	1	3	8/5784	6000	337 4	16 760	16 [illegible]	41	41 100
Water Temp - Overflow		87	86	86	85	85	84	86	88	91	91	92	92	90	90	90	90	92	92	89	88	89	89	88	87	4	8/5790	6000	338 1	16 [illegible]	16 [illegible]	41	40 [illegible]
Term Diff - Cond & Overflow		-1	-1	-1	-1	-1	-1	-1	1	3	3	3	3	1	3	4	-3	3	-2	3	-1	-2	4	-2	-2	5	8/5795	5000	339 1	82 [illegible]	16 91	94	94 100
Water Temp - Injection		83	83	83	83	83	83	82	82	82	82	83	83	82	82	82	83	84	83	83	83	82	82	82	82	6	8/6001	6000	339 7	82 [illegible]	17 68	41	40 95
Temp. Rise Inj & Over		4	3	3	2	2	1	4	6	4	4	4	4	5	8	8	8	9	8	6	5	4	6	5	6	7	8/6010	9000	340 5	124 [illegible]	13 76	41	41 96
Exhaust Steam Temp.		92	89	90	90	90	90	90	94	98	99	100	99	96	98	100	100	99	99	99	94	94	92	92	92	8	8/6024	14000	341 8	177 [illegible]	12 7	82	81 96
Air Pump Suction Temp.		90	90	88	87	87	86	87	87	93	94	94	94	91	94	94	94	96	96	91	90	90	88	92	90	9	8/6041	17000	343 2	191 [illegible]	11 26	82	80 92
Vacuum		28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	10	8/6056	15000	344 6	171 [illegible]	12 [illegible]	83	81 92
Turbine Speed R.P.M.		1375	1375	1374	1379	1375	1375	1375	1470	1470	1470	1463	1478	1476	1375	1388	1380	1380	1380	1380	1380	1365	1365	1365	11	8/6073	17000	346 2	218 [illegible]	12 87	83	81 92
Circulating Pump Speed																									12 N	8/6087	14000	347.4	164 [illegible]	11 72	85	82 90
Condensate " "																									1 PM	8/6102	15000	348 6	164 [illegible]	10 74	88	84 86
Air " "		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	2	8/6116	14000	350.1	205 [illegible]	14 63	90	86 86
Press. at Cond Inlet																									3	8/6133	17000	351 8	213 [illegible]	13 66	90	87 80
" " Outlet																									4	8/6147	14000	353 2	191 [illegible]	11 [illegible]	85	85 100
" Drop thru Condenser																									5	8/6163	14000	354 4	164 [illegible]	11 22	84	83 96
Temp on Cir Pump																									6	8/6174	11000	355 4	136 [illegible]	12 [illegible]	84	83 96
Sucn. " Con. "		285	285	270	270	290	285	270	275					220			225	210	200	190	300	300	290	270	285	7	8/6183	9000	356 3	113 [illegible]	13 68	84	83 95
" " Air "																									8	8/6191	8000	357	95 [illegible]	11 72	84	83 95
" " Overflow		7	7	5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5	7	7	7	7	7	7	9	8/6199	8000	357	95 [illegible]	11 72	84	83 95
Steam Press. at Throttle		13	11	11	12	12	14	12	12	13	12	11	11	11	11	11	11	11	11	11	12	11	13	12	11	10	8/6208	9000	357 8	95 [illegible]	10 [illegible]	84	83 95
" " 1st Stage		230	236	235	235	235	235	235	235	228	224	227	225	223	232	227	210	227	230	230	235	227	200	232	225	11	8/6218	12000	359 1	130 [illegible]	12 17	83	82 95
" Temp. at Throttle		45	32	27	25	26	20	35	51	41	34	180	44	68	85	180	89	92	70	29	39	39	62	47	49	12	8/6230	14000	361 2	151 [illegible]	11 [illegible]	83	83 95
Saturated Steam Temp.		540	540	545	535	535	540	530	535	535	540	540	535	535	535	540	540	540	540	540	540	540	530	540	530	13	8/6243	13000	363 4	144 [illegible]	11 08	83	83 95
Degrees of Superheat		379	401	401	401	401	401	401	401	393	396	399	396	394	396	399	399	396	395	391	398	395	370	392	392	14	8/6255	12000	365 1	130 [illegible]	10 83	83	83 95
Press. of Oil on Hydraulic		151	139	144	134	134	134	129	134	137	140	143	145	136	136	138	135	142	142	142	140	140	138	142	142	15	8/6267	12000	366 8	130 [illegible]	10 83	83	83 95
" " Bearings		67	64	64	64	64	64	64	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	16	8/6280	13000	368	136 [illegible]	10 46	83	83 95
" Water "		13	13	13	13	13	13	13	13	09	08	10	12	12	9	13	13	12	12	12	12	13	13	13	12	17	8/6293	13000	369 4	140 [illegible]	10 77	83	82 95
Bearing Oil Temp. to Cooler		26	26	26	26	26	26	26	25	25	25	25	24	25	26	26	26	26	26	26	26	26	26	26	26	18	8/6307	14000	371 1	144 [illegible]	10 29	83	82 95
" " " from "																									19	8/6321	14000	372 9	144 [illegible]	10 29	83	82 95
Temp. Oil at Turb. Bearing		142	142	142	142	142	142	142	142	146	146	146	148	146	148	148	150	150	146	144	144	144	144	144	144	20	8/6330	13000	374 2	144 [illegible]	11 08	83	82 95
" " " Mid. "		156	156	157	156	156	156	156	158	152	153	153	154	155	154	154	153	154	154	154	154	154	155	156	156	156							
" " Gen. "		150	150	150	150	150	150	150	148	141	145	148	150	150	150	149	150	150	150	150	150	150	150	150	150								
" " " Bear		166	167	169	167	167	167	166	164	165	165	165	166	166	166	164	164	166	166	164	164	164	164	164	166								
Air Temp. enter Air Wash.																																	
" " leave. "																																	
Barometer Reading		29.48	29.48	29.48		29.48	29.48	29.48	29.48	29.48	29.48	29.48	29.48	29.46	29.46	29.46	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.48								

TURBINE ROLLING | TURBINE ON LINE | TURBINE OFF LINE

Circulating Motor off 7[35] A M
on 11[10] A M
off 12[35] P M
on 2[40] P M

Steam Exciter on 2[40] P M
Charging batteries.

RESULTS ENGINEER H.W. Miller TURBINE ENGINEER C.J. Hummel TURBINE ENGINEER Geo. Farris TURBINE ENGINEER

ACME POWER CO.

NO. 2 BOILER REPORT

FORM OPR 201

DATE June 20. 1910

STOKER

	IDEAL WORKING CONDITION	12 M	1 AM	2	3	4	5	6	7	8	9	10	11	12 N	1 PM	2	3	4	5	6	7	8	9	10	11
Boiler Condition		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Steam Pressure		240	250	245	245	245	245	245	237	225	228	225	234	230	226	223	240	245	245	238	250	250	242	220	250	250
Indicate Steam Flow No. 1 Meter		85	45	40	20	50	40	40	30	75	80	80	75	45	60	75	80	70	55	50	55	70	70	85	55
" " " " 2 "		65	40	25	35	35	20	30	15	70	75	80	75	40	60	70	80	70	50	75	50	70	40	80	50
Air Flow No 1 Meter					40				70			80	75	60	70	80	85	70	65	75	60	75	80	70	60
" " 2 "																									
Steam Calorimeter																									
Draft at Chimney		1	.9	.9	.9	.9	.9	1	1	1.2	1.4	1.4	1.4	1.3	1.3	1.3	1.4	1.3	1.3	1.2	1.1	1.2	1.2	1.2	1.2
" " Exit of Economizer																									
" " Ent. " "																									
" " Uptake		.3	.3	.2	.2	.2	.2	.2	.4	.4	.4	.3	.3	.2	.3	.3	.3	.2	.2	.3	.2	.3	.3	.3	.3
" over Fire		.0	.01	.01	.0	.01	.0	.01	.03	.01	.03	.02	.03	.03	.02	.02	.02	.03	.03	.03	.03	.03	.03	.02	.04
Wind Box Pressure		16	0	.4	1.6	.4	6	6	1	2.1	2	2	14	.8	1.5	2.0	2.0	1.7	1.2	1.4	1.0	1.8	2.6	1.6	0
CO_2									—	—	5	14	13	11	13	11	13	12	11	11	12	10	12	11	11
Flue Gas Temp leav Boiler		570	530	510	530	540	520	520	505	630	675	650	620	560	625	630	670	620	570	570	570	580	600	570	580
" " Econ.																									
Temp drop thru Econ.																									
Feedwater Temp leaving Econ																									
" " entering "																									
Temperature rise																									
Temp. Steam leaving Boiler		540	540	540	545	540	540	540	510	530	550	550	525	540	540	540	545	530	550	530	555	545	535	525	535
" Saturated Steam																									
Degrees of Superheat																									
Ind Stoker Speed																									
Blowed Down Boiler		12[30]																							
Stoker Dumped		12[M]				5[00]			9	10		12[00]		2[00]											
Ash pit "																									

TIME	READING REVOLUTION COUNTER	REVOLUTIONS	K W H	REMARKS Coal / hr	Coal / K W H
12 M	16454	41	8,000	1.76 80	2.43
1 AM	16485	31	8000	15 360	1.92
2	16503	18	6000	12.960	2.16
3	16523	20	6000	14400	2.40
4	16538	15	6000	10320	1.72
5	16556	18	5000	13680	2.73
6	16581	25	6000	15120	2.52
7	16606	25	9000	24960	2.78
8	16647	43	14000	29560	2.04
9	16644	45	17000	33600	1.97
10	16745	51	15000	32.360	2.15
11	16942	47	17000	32880	1.93
12 N	16817	27	14000	26.400	1.88
1 PM	16855	36	15000	27840	1.85
2	16873	38	14000	27600	1.97
3	16934	41	17000	27280	1.72
4	16986	52	16000	36240	2.26
5	17016	30	14000	22320	1.59
6	17044	28	11000	21.120	1.92
7	17077	33	9000	16.800	1.87
8	17107	32	8000	17640	1.83
9	17155	46	9000	20640	2.29
10	17217	62	12,000	21600	2.30
11	17243	26	9000	14640	1.62
12M					
TOTAL					

SOOT BLOWERS BLOWN 11:11 A.M. | 1:30 P.M.

Boiler Repairs:-Taken off line at M. 19 Account of

Tubes WASHED BORED Scraped tubes in Put in new tubes

Steam Drums Open up Washed out Sealed

Mud Drums. Open up Washed out Sealed

Superheater Caps: Took off caps. Put on new caps nuts bolts clamps

Blow-off Valves.

Valves

R-Running. B-Banked. O-Cut-out

Flue Dirt Pit. Cleaned

Bridge Wall Used brick Side Wall Used brick

Baffles. Put in baffles tile, arch, other parts

Stoker Put in seams, dump plates, levers, hinges,

grates, tuyere brackets

Other Stoker parts

Boiler on line O.K. M 19 Off line days hours.

Reported by Inspected by State Inspector No

Cleaned Side Walls.

RESULTS ENGINEER W Gates STOKER ENGINEER C Reau STOKER ENGINEER B Nelson STOKER ENGINEER

ACME POWER CO.

HEATER ROOM REPORT

FORM OPR 200

DATE June 20 1919

IDEAL WORKING CONDITIONS	12 M	1 AM	2	3	4	5	6	7	8	9	10	11	12 N	1 PM	2	3	4	5	6	7	8	9	10	11
Temp Inlet Water No 1 Heater	94	94	98	94	93	93	92	93	98	100	100	101	100	100	100	102	100	100	98	96	96	96	96	96
" Outlet " No 1 "	210	210	210	210	210	210	204	200	206	206	205	202	170	202	206	170	189	211	206	206	210	202	192	194
" Inlet " No 2 "	116	116	116	116	117	117	112	109	108	106	103	101	96	102	106	86	89	111	108	110	114	106	96	98
" Outlet " No 2 "																								
" Inlet																								
" Exhaust Steam	240	235	240	240	235	240	235	230	230	230	230	230	230	230	230	230	235	230	230	230	235	230	230	230
Press " "																								
" Steam No 1 Feed Pump	275	280	275	280	270	275	280	275	275	280	280	280	280	280	280	270	280	270	280	280	275	280	275	275
" " No 2 " "																								
" Water No 1 " "																								
" " No 2 " "																								
" " No 1 Supply "	43	43	43	43	43	43	44	42	42	43	42	42	43	41	43	37	44	44	44	43	43	43	43	43
" " No 2 " "	44	44	44	44	45	45	48	48	48	44	46	48	47	47	47	44	47	47	47	47	47	46	47	47
" " No 3 " "																								
" " No 4 " "																								
" " No 5 " "	39	36	39	39	35	35	35	35	39	39	39	41	36	36	39	39	39	39	39	39	39	36	34	34
Head on No 1 Feed Pump																								
" No 2 " "																								
Suction on No 1 Supply Pump																								
" No 2 " "																								
" No 3 " "																								
" No 4 " "																								
" No 5 " "																								
Press No 1 Press Stor Tank																								
" No 2 " "																								
" No 3 " "																								
" No 4 " "																								
Depth of Water in H W Tank																								
" " " C W "																								
" " " F W "																								
" " " S W "																								
Suction on House Supply																								
Head on " "																								
Steam Entries Condy																								
Oil Temp in Gear Case																								
Voltage																								
Amp																								
Main Feeder Voltage																								
" " Amp																								

TIME	CITY WATER METER READ	CONDENSATE METER POINTS	CONDENSATE No 2 Blow POINTS	MAKE UP METER	MAKE UP POINTS	TOTAL WATER Boiler Feed No 1 Blow	No 2 Blow	TOTAL
12 M	3420		1715	7477		5844		
1 AM								
2								
3			1742	7481		5180		
4								
5								
6			1764	7486		5243		
7			1775	7487		5342		
8								
9			1818	7488		5330		
10								
11								
12 N			1870	7491		5791		
1 PM								
2								
3			1926	7492		6014		
4								
5								
6			1979	7496		6248		
7								
8								
9			2010	7499		6376		
10								
11			2035	7502		6320		
12M			2045	7502		6359		
TOTAL								

TIME

SPEED NO 1 FEED PUMP R P M

" " 2 " " "

" " 1 SUPPLY

" " 2 " " "

" " 3 " " "

" " 4 " " "

" " 5 " " "

NOTES

240 234 242 244 246 246 244 244 244 242 247 247 242 242 244 244

RESULTS ENGINEER

OPERATOR

OPERATOR

OPERATOR

[OL]ME POWER CO

WATER SOFTENER REPORT

DATE Jun 20, 1913

TIME	TANKS	BEGAN FILLING (TIME)	TANK FILLED (TIME)	BEGAN USING (TIME)	TANK EMPTY (TIME)	CHARGES: LIME (POUNDS)	CHARGES: SODA ASH (POUNDS)	CHARGES: IRON SULPHATE (POUNDS)	LIME TREATMENT TESTS: SILVER NITRATE TEST	LIME TREATMENT TESTS: ALK. READING	LIME TREATMENT TESTS: MG READING	LIME TREATMENT TESTS: H	LIME TREATMENT TESTS: C	SODA TREATMENT TESTS: CALCIUM CHLORIDE TEST	SODA TREATMENT TESTS: PH READING	SODA TREATMENT TESTS: MG READING	SODA TREATMENT TESTS: H	SODA TREATMENT TESTS: C	SODA TREATMENT TESTS: H	WASHED FILTER: TIME	WASHED FILTER: NO 1	WASHED FILTER: NO 2	WASHED FILTER: NO 3	WASHED FILTER: NO 4
	#2	3[illegible]	5 30			84	100	10	1.4	1.7	2.5	9	1.6	HT	5.2	7.5	2.4	4.6	3.	8 am				

	IDEAL WORKING CONDITION
Press. in Inlet No. 1 Press. Filter	40
" Outlet " 1 "	40
" Inlet " 2 "	40
" Outlet " 2 "	40
Filter No. 1 Washed	8 AM
" " 2 "	
Speed of Chemical Pump	1430
" Air Wash "	720
" Agitator Motor	720
Press. on Air Wash	

TIME: 12M 1 AM 2 3 4 5 6 7 8 9 10 11 12N 1 PM 2 3 4 5 6 7 8 9 10 11

CHEMICALS	LIME	SODA ASH	IRON SULPHATE
CHEMICALS IN STOCK	8720	14213	940
CHEMICALS USED TODAY	84	100	10
CHEMICALS IN STOCK	8636	14113	930
TIME			

Boiler Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Salt Test																																
Alkalinity Test																																
Caustic "																																
Hardness																																

V C Miller

OPERATOR

FORM OPR 508

ACME POWER CO.

STORAGE BATTERY DAILY REPORT

DATE 19

INDIVIDUAL CELL READINGS

SPECIFIC GRAVITY READINGS TAKEN A. M. P. M. VOLTAGE READINGS TAKEN A. M. P. M.

CHARGING CURRENT WHILE TAKING VOLTAGE READINGS AMPERES

CELL	SPECIFIC GRAVITY	VOLTS	CELL	SPECIFIC GRAVITY	VOLTS	CELL	SPECIFIC GRAVITY	VOLTS	CELL	SPECIFIC GRAVITY	VOLTS
1			31			61			91		
2			32			62			92		
3			33			63			93		
4			34			64			94		
5			35			65			95		
6			36			66			96		
7			37			67			97		
8			38			68			98		
9			39			69			99		
10			40			70			100		
11			41			71			101		
12			42			72			102		
13			43			73			103		
14			44			74			104		
15			45			75			105		
16			46			76			106		
17			47			77			107		
18			48			78			108		
19			49			79			109		
20			50			80			110		
21			51			81			111		
22			52			82			112		
23			53			83			113		
24			54			84			114		
25			55			85			115		
26			56			86			116		
27			57			87			117		
28			58			88			118		
29			59			89			119		
30			60			90			120		

PILOT CELL READINGS

Max. Sp. Gr. on Equalizing Chge. ..... Temp. .....

Are Sp. Gr. Readings Corrected for Temp? Yes. No.

EQUALIZING CHARGE READINGS

15 MINUTE INTERVALS (AFTER GASSING STARTS)

AVERAGE CURRENT

.....AMPS.

TIME	SPECIFIC GRAVITY
1 A. M.	
2 "	
3 "	
4 "	
5 "	
6 "	
7 "	
8 "	
9 "	
10 "	
11 "	
12 NOON	
1 P. M.	
2 "	
3 "	
4 "	
5 "	
6 "	
7 "	
8 "	
9 "	
10 "	
11 "	
12 NIGHT	

START OF CHARGE	END OF CHARGE
TIME	TIME
SP. GR.	SP. GR.
TEMP.	TEMP.

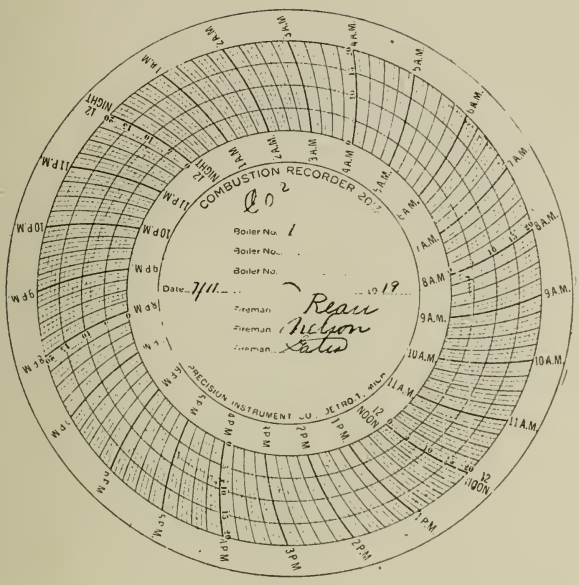
NOTES:-

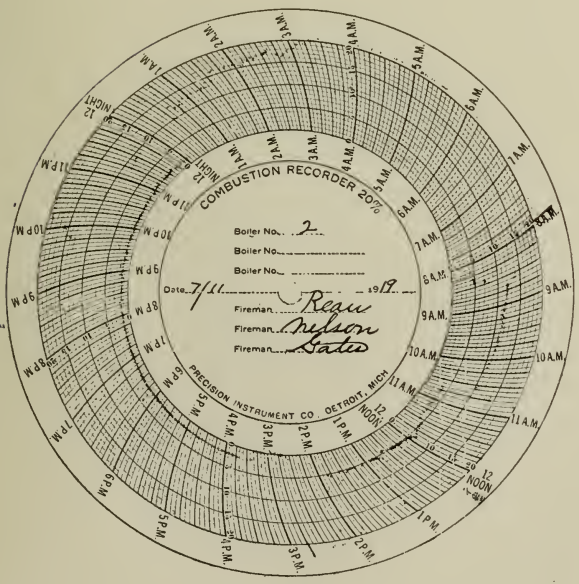
Cells (Nos.) not gassing properly on equalizing charge

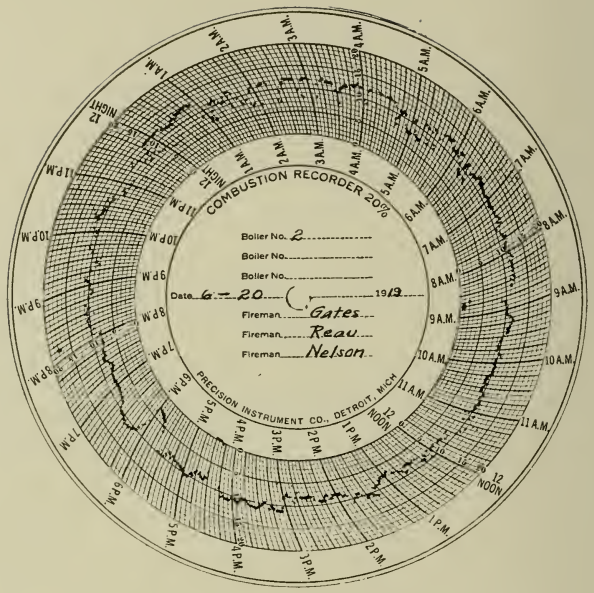
Water was added to replace evaporation in cells (Nos.)

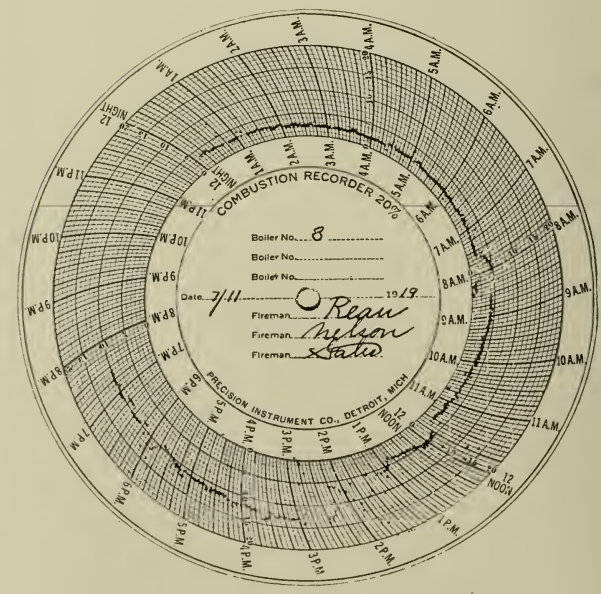
Cells (Nos.) inspected

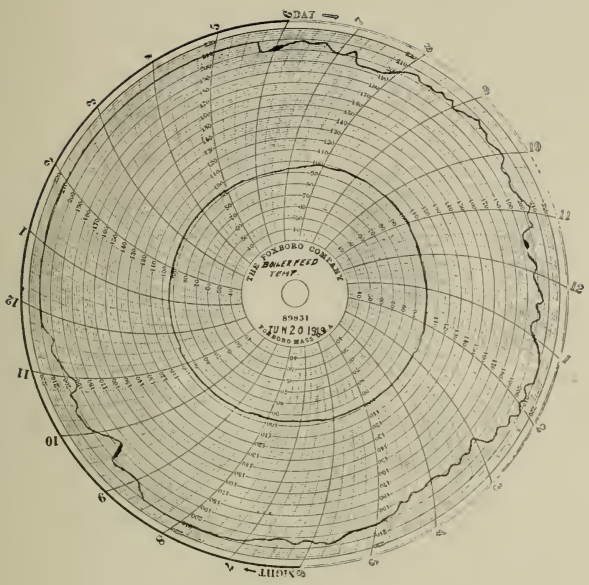
Cells (Nos.) given special attention (state attention given below)

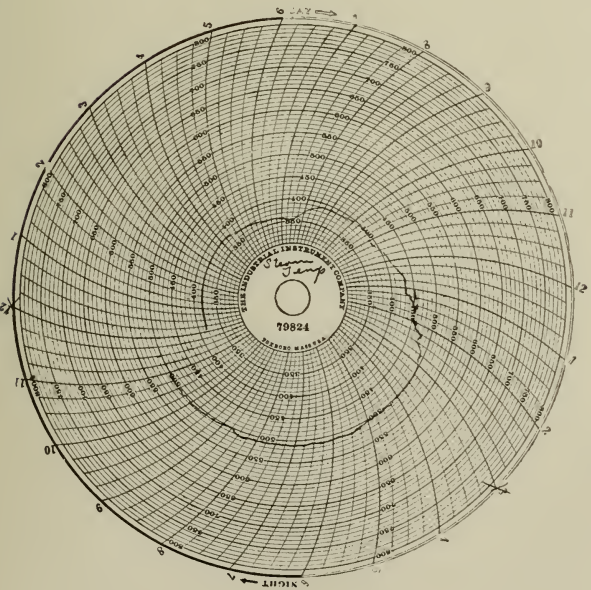

COMBUSTION RECORDER 20
Boiler No. 1
Boiler No.
Boiler No.
Date 7/11 19
Fireman Regan
Fireman Nelson
Fireman Gates
PRECISION INSTRUMENT CO. DETROIT, MICH.

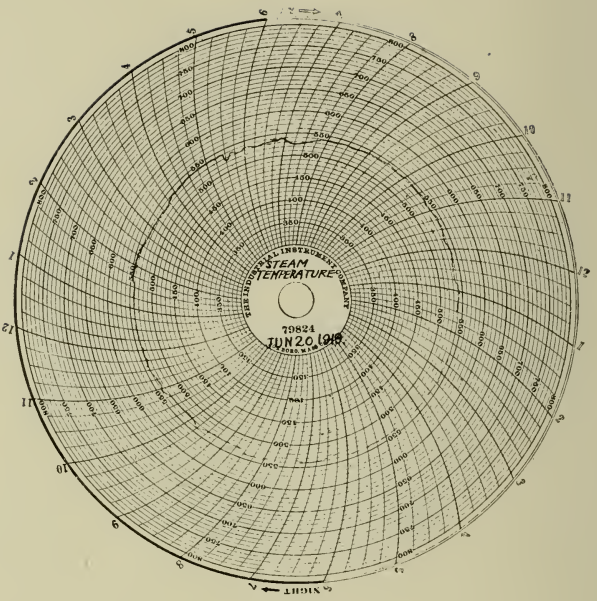

COMBUSTION RECORDER 20
Boiler No. 2
Boiler No.
Boiler No.
Date 7/11 19
Fireman Regan
Fireman Nelson
Fireman Gates
PRECISION INSTRUMENT CO. DETROIT, MICH.

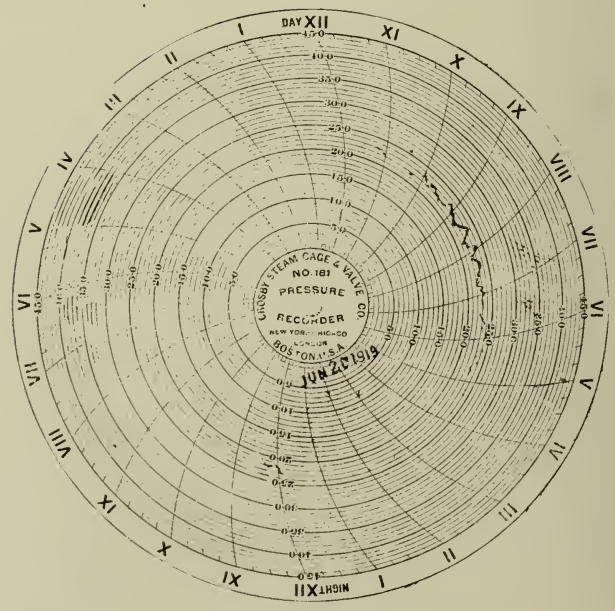

COMBUSTION RECORDER 20%
Boiler No. 2
Boiler No.
Boiler No.
Date 6-20 19
Fireman Gates
Fireman Reau
Fireman Nelson
PRECISION INSTRUMENT CO., DETROIT, MICH.

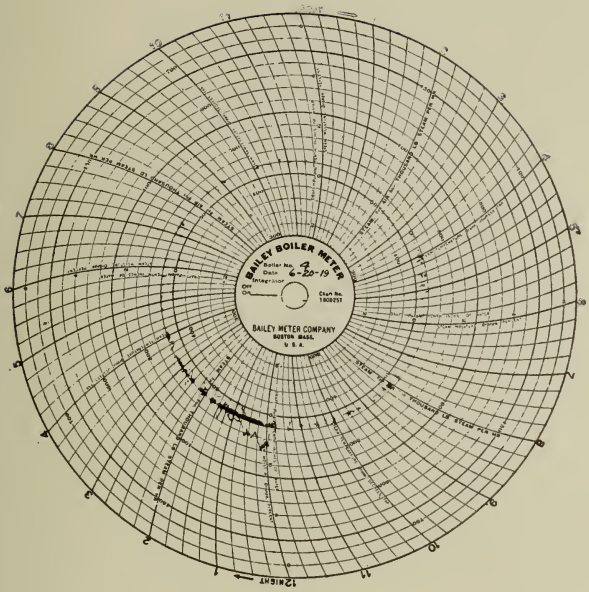

COMBUSTION RECORDER 20%
Boiler No. 8
Boiler No.
Boiler No.
Date 7/11 19
Fireman Reau
Fireman Nelson
Fireman Gates
PRECISION INSTRUMENT CO., DETROIT, MICH.

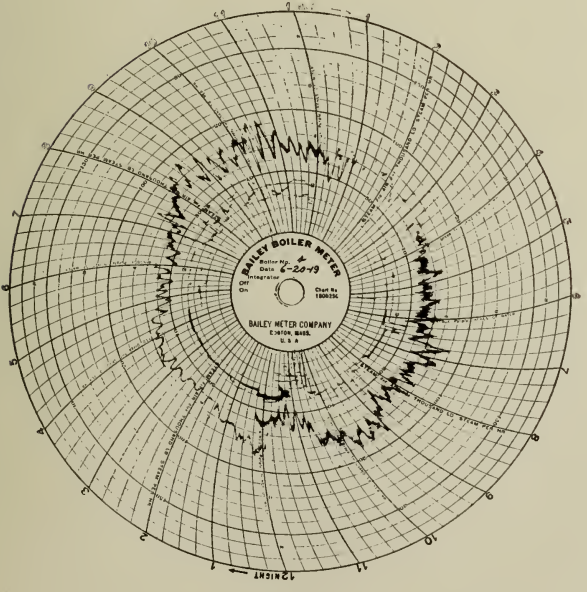

DAY
NIGHT
THE FOXBORO COMPANY
BOILER FEED TEMP
89831
JUN 20 1913
FOXBORO MASS

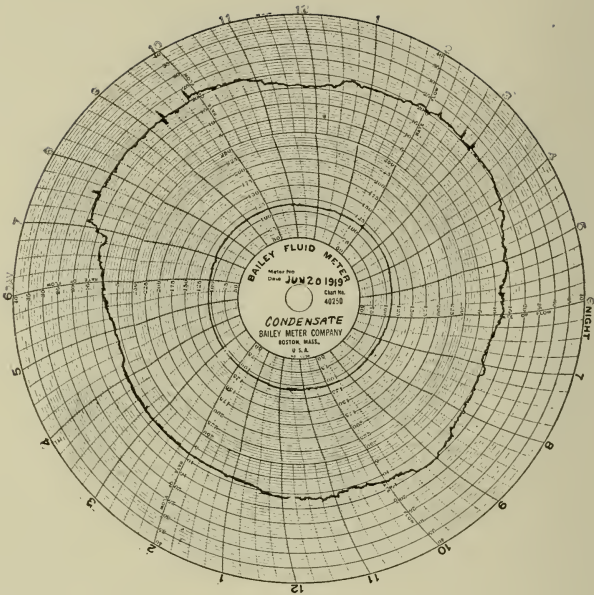

DAY
NIGHT
THE FOXBORO COMPANY
Engine Temp
79824
FOXBORO MASS

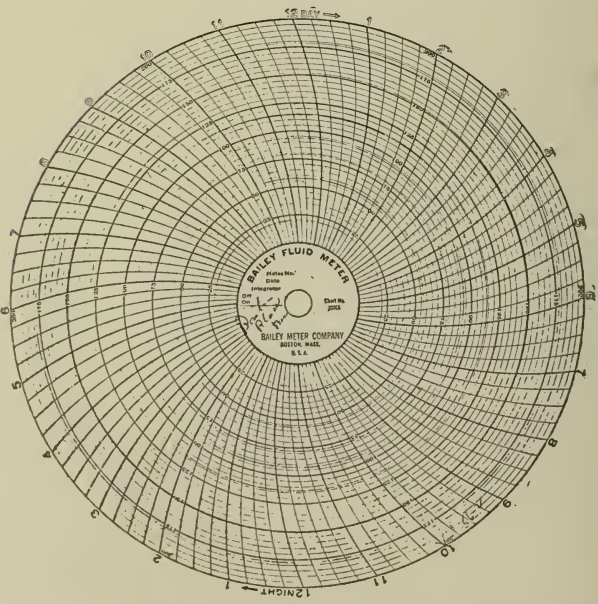

STEAM
TEMPERATURE
79824
JUN 20 1918
NIGHT

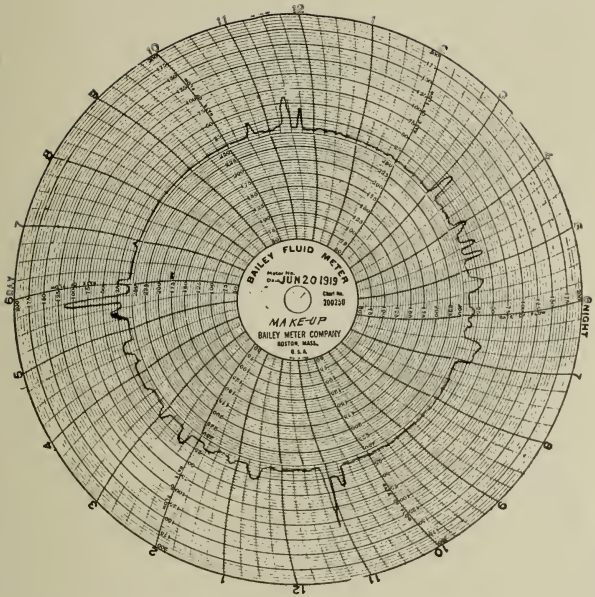

DAY XII
CROSBY STEAM GAGE & VALVE CO.
NO. 181
PRESSURE
RECORDER
BOSTON, MASS.
JUN 27 1918
NIGHT XII

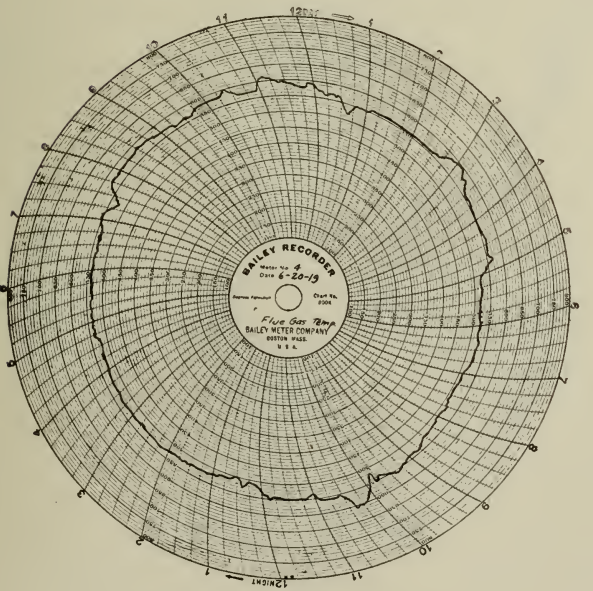

BAILEY BOILER METER
Boiler No. 4
Date 6-20-19
Integrator
Off
On
Chart No. 1902257
BAILEY METER COMPANY
BOSTON, MASS.
U. S. A.
12 NIGHT

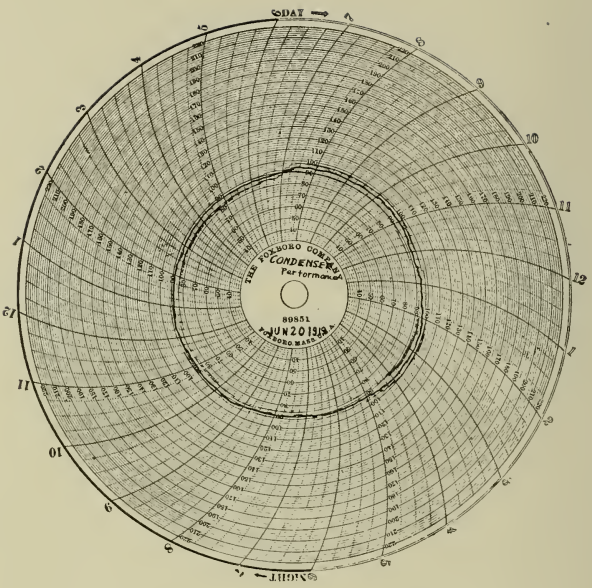

BAILEY BOILER METER
Boiler No. 4
Date 6-20-19
Integrator
Off
On
Chart No. 1906256
BAILEY METER COMPANY
Easton, Mass.
U. S. A.
12 NIGHT

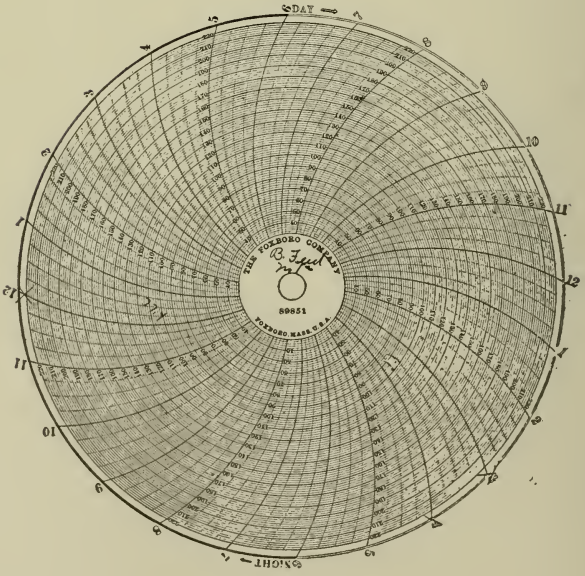

BAILEY FLUID METER
Meter No.
Date JUN 20 1919
Chart No. 4059
CONDENSATE
BAILEY METER COMPANY
BOSTON, MASS.
U.S.A.
12 NOON
6 PM
12 NIGHT
6 AM

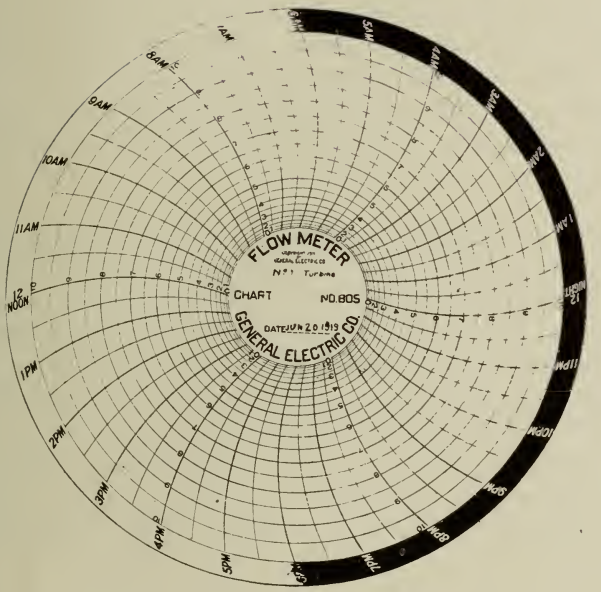

12 NOON
BAILEY FLUID METER
Meter No.
Date
Integrator
On
Off
Chart No.
2008
BAILEY METER COMPANY
BOSTON, MASS.
U.S.A.
12 NIGHT


BAILEY FLUID METER
Meter No.
Date JUN 20 1919
Chart No. 100130
MAKE-UP
BAILEY METER COMPANY
BOSTON, MASS.
U.S.A.
MIDNIGHT
MIDNIGHT


BAILEY RECORDER
Meter No. 9
Date 6-20-19
Chart No. 2005
Flue Gas Temp
BAILEY METER COMPANY
BOSTON MASS.
U.S.A.
12 NIGHT


DAY
NIGHT
THE FOXBORO COMPANY
CONDENSER
Performance
89851
JUN 20 1913
FOXBORO MASS. U.S.A.


DAY
NIGHT
THE FOXBORO COMPANY
89851
FOXBORO MASS. U.S.A.


FLOW METER
CHART
NO. 805
DATE JUNE 20 1913
GENERAL ELECTRIC CO
No 1 Turbine
12 NOON
1PM
2PM
3PM
4PM
5PM
6PM
7PM
8PM
9PM
10PM
11PM
12 MIDNIGHT
1AM
2AM
3AM
4AM
5AM
6AM
7AM
8AM
9AM
10AM
11AM

The paper was received with applause.

Discussion.

President Oppenheimer: Gentlemen, you have heard the Report of the Station Operating Committee, also the excellent paper prepared by Mr. Strike; all of which contains considerable food for thought and is worthy of your attention and full discussion. We are now ready to take up the discussion and would like to hear from as many of you as possible upon the subject. We know that you are all interested in this particular Report because the economies to be obtained by proper station operation during this period of high cost of living are highly essential to all of us; and if there is anythng that can be brought out in this discussion that will be of benefit to any one or more companies we ought to hear it now. I wonder if Mr. De Forest would not open up the discussion with a few words?

Mr. C. W. De Forest, Cincinnati: I have always thought that most stations were being operated at efficiencies of from 75 to 80%, but to obtain the last 15% you have to know where your costs are. In order to do that you should institute some sort of uniform cost system. You should not only know at the end of each month just where your costs are, but you should know it at the time the coal is being burned, or at the time that the vacuum is low. I believe that we can all gain a great deal by keeping up some uniform system. Some Stations need very much more elaborate systems than others. Systems for smaller Stations need not be as elaborate but in each case can be adapted to the particular use of the Station.

Mr. L. W. Wallau, Cleveland: I would lke to make a suggestion in connection with Mr. Strike's paper, that the data sheets which he used be reproduced in the Monthly Bulletin. I think the data sheets if printed in connection with the paper would make a complete whole which would be of great interest to the operating man. Without the data sheets it would be hard to determine what records are kept.

Secretary Gaskill: I would like to ask whether it would not be a good plan to print Mr. Strike's paper in an early number of the Monthly together with cuts of these data sheets. You know we are de-

layed somewhat in getting out our regular bound volume of Proceedings. About the best I can do is to promise you that by the first of December. I promised it by the first of December last year, and I got it to you about the first of June. That indicates about how the printers are working in these post-war days. I think it would be a good thing to reproduce Mr. Strike's paper in an early number of the Monthly. If you wish me to do so, I will do it.

Mr. William Long, Toledo: I do not beleve that that paper is complete without the data sheets being included. I know the paper is quite complete with them. They have a very good system at the Acme Power Company. In traveling through the State I find that there is a great lack of keeping the proper data, and I think there is a good deal that the Station Operating Committee can do in improving that situation.

Secretary Gaskill: I would state in explanation that that reason the cuts are not with the paper is because Mr. Strike just finished his paper last week, and he wrote me that it was impossible for him to furnish me with the necessary cuts. He expected to illustrate his paper with lantern slides, but he wrote me that he could not do that and would have to depend upon giving the illustrations later in the Proceedings. But I will arrange to get the data sheets from him and have cuts made for the Monthly.

President Oppenheimer: I see that Mr. Bromley has come in. Can we not hear from him in reference to this paper?

Mr. H. W. Bromley, Youngstown: I was delayed in getting here and I heard very little of the paper, so that it would be impossible for me to make any comments upon it until I can digest it in some way. In our organization we have our own method of working up costs. We try to work them up as economically as possible.

President Oppenheimer: We thought that you had taken part in the work of the Committee and were very familiar with it. Perhaps then you can offer some suggestions for the future work of the Operating Committee? If so, we would like the benefit of your

thought in the matter, which we know would be of interest to the operators here.

Mr. H. W. Bromley, Youngstown: There is no question in my mind or in any progressive engineer's mind, I believe, but what data should be digested by him every day so that he may know what has been done the day before, and that this is of the very greatest benefit He should have before him every day the showing in curves of the actual operating of the system and also the costs as made up in curves so that he can see at a glance whether he is making correct estimates or not. In order to produce economies you must have exact information in front of you, and the cost of getting that information is very little as compared with the benefits to be derived from it. If you see your operating curve day by day plotted out for you you know just how much money you are spending for each item as compared with the amount of money you estimated would take care of that item for that particular month or that particular day. Then you know when you are going wrong and when it is time to retrench. We all have to do the retrenching act in public utility work. All of our steam roads throughout the country must at times retrench; and having the information in front of you each day puts you in a position where you can tell your men to retrench when necessary.

President Oppenheimer: Can we hear from Mr. Sloat of Sandusky? of Sandusky?

Mr. R. G. Sloat, Sandusky: I do not know of anything more that I can add in regard to the value of keeping these records. There is no question in any of our minds as to the value, which cannot be computed in dollars and cents but is something that there is no way of getting at fully, but we know the value is there.

Mr C. W. De Forest, Cincinnati: In regard to printing those sheets it might be a good idea to have them show a sample day's run. That will show you how they are used.

Mr. George E. Miller, Cleveland: In regard to printing those data sheets, very often in Transactions, Journals, etc., when data sheets, tables and curves are printed they are so reduced in size as to be almost

useless. I want to suggest that these data sheets when issued be issued in such form that they can be read.

Secretary Gaskill: I do not believe that the Monthly can be accused of sinning very much in that direction, because my instructions to my engravers are always to make things plain and legible regardless of what he has to do as to size. I do not think that many of our cuts have been illegible on account of being too much reduced, we generally have them in pretty fair shape. But I will look after that.

Mr. W. S. Culver, Cincinnati: My suggestion would be to secure from the Acme Power Company actual forms that will illustrate the matter exactly. I do not know how much it will cost. You can use them better in that way than you can use a facsimile printed in a publication.

Mr. C. H. Spiehler, Dayton: Without having these data sheets on hand it is rather hard to discuss the paper. It would seem to me that a lot of this data it would not be necessary to keep each day, or at least to keep it as to cost in fractions of a cent. If you keep account of the actual economies that are taking place in a Station that is sufficient in most cases, such as evaporation, B.t.u. per Kw. h., pounds of steam per Kw., coke per Kw. and per pound. Such data as that it would not be necessary to carry out, as I said before, in dollars and cents costs all the way through. The most of us do not have any more help around the station than we need, and we very seldom do maintenance work; it is not necessary.

President Oppenheimer: Mr. Howell is a man who has had considerable experience in all departments of the industry. I think he has been in very close touch with power house operation. And I would like to hear from our Vice-President.

Vice-President C. H. Howell, Coshocton: As Mr. De Forest said, the last fifteen or twenty per cent. of the one hundred per cent. efficiency is the saving that is most valuable, and likewise that which is the hardest to get. I am myself particularly interested in the smaller size Stations, and it has been quite a question with us as to how far to go with this system of cost-keeping. I can quite readily see that an elabo-

rate system of cost-keeping such as is kept in the Acme plant would no doubt be quite too expensive for a 5,000 or 10,000 kw. plant. The next question then is, how much can you afford to spend on this system of cost-keeping? As Mr. Spiehler says, the number of pounds of coal per Kw. h., the evaporation per pound of coal, those things are certainly necessary to be known in every plant, and should be computed daily. The Chief Engineer should watch those things from day to day. The question of maintenance, however, I think is one which the smaller Stations overlook, and thus they may at times find their outlay too great in proportion to results. I do believe from the experience I have had with a few of the smaller Stations that I have had the privilege of estimating, that many such Stations do not keep enough data on their maintenance costs.

Mr. J. C. Martin, Columbus: Mr. President and Gentlemen of the convention, I was heartily in favor of an appropriation to publish this article and also the sheets in connection therewith until a gentleman sitting next to me showed me a list of the sheets covering only one day's operation. There are eleven of these sheets, all of pretty good size, in order to cover one day's operation. To keep that record in a small plant would require an expert engineer on the job all the time, because the records are made up at least hourly of the temperature of the stack and flue gases, coal used, temperature of condensing water, and all that, and we know that one man would be quite busy keeping those records. That is all well and good for a large plant; but we must remember that the large plants in Ohio are very few as compared with the medium-sized and small plants. The membership of this Association is made up of all classes from the largest to the smallest plants in Ohio.

Now it has occurred to me that this system of the Acme Power Company would be all right for the larger plants, but that would only be taking care of what we might term the aristocracy of the Association and not reach the common fellow. I think it would be well for the Committee to do as we did with the Accounting System, that is, prepare a set of sheets that would be applicable to the different size companies, because the small companies with their present high expenses could not afford to keep an expert engineer on the job that would be capable of accurately keeping all this data or of analyzing or digesting it, preparing curves, and submitting it to the head of the company for his considera-

tion and final action; and unless it does finally reach the heart of the concern, the man that controls the pocketbook and who has the say so as to what shall be spent and what should be curtailed, it is of no value. So I think it would be better rather than publish eleven different pages of this system of accounting that the matter be so worked out as to be applicable to say three or four different size companies, beginning with the larger companies to which it is certanly applicable and on down to a reasonably small company, and then everybody will profit by the work of the Committee and the work of the Association.

Secretary Gaskill: I think Mr. Martin has hit the nail on the head pretty well. Now I represent one of the smaller companies, and at least with the force I have now there is no use in giving them all of those sheets of the Acme Power Company. On the contrary, we ought to have some simplified method that would give fairly good results. There are probably not over fifteen plants in the State of Ohio that could use the system of the Acme Power Company in anything like a complete form. Now the personnel of the engineers in the smaller plants is different from that of those in charge of the large plants. I know in my own case, speaking of the "aristocracy" of the profession the Lord left out that element when he created some head engneers, he let that go to Mr. De Forest, Mr. Spiehler, Mr. Bromley and a lot of men like them over the State. Sometimes there is such a thing as getting too complicated a set of reports. I do not know whether Mr. Culver's suggestion is possible or not. I happen to know that Toledo Railway and Light bunch pretty well; a finer lot of fellows you never met; I believe I could go up there and get them to inveigle enough sheets out of the Acme Power Company to supply all of the "aristocracy," there is no use to give them to the plain fellow down below; now what do you say to that proposition?

Mr. C. W. De Forest, Cincinnati: I do not think those sheets as they are can be used by any of the Stations. Every Station has to have sheets worked up to suit its own layout; but those sheets are given to you to illustrate the points you want to cover. From those they can work out what they want to cover their own particular situation. The smaller Stations do not want any very elaborate system, they want a cost system that will cover the items that are essential for them to keep track of in

order to maintain their thermal efficiency. But the cost of keeping that data I do not think is the only thing that should be considered, but rather what you are going to save. If you can by the use of them save twice ther cost, then they are a profitable proposition; otherwise, not. It is all a matter of cost.

Mr. William Long, Toledo: I believe that the system that they have at the Acme Power Station has probably increased with the size of the plant. Each plant should have a system such that they will know what their detailed costs are. That is the principle set forth in the paper. The system need not necessarily be elaborate, but the thing is to get at your costs daily. If you know what your daily cost is you do not have to wait until the end of the month, but every day you will know just where you stand. That is the principle of the paper.

Mr. W. L. Wallau, Cleveland: The idea is that Mr. Strike has presented a paper which describes in detail a certain system of keeping daily unit data at the Acme plant at Toledo; but without the forms from which he gathers his information we do not know how he does it. In order to understand the paper we ought to have the forms that he refers to.

President Oppenheimer: Mr. Bailey represents interests that are extensively identified with power house operation. We would like to hear from him.

Mr. E. G. Bailey, Baley Meter Co., Cleveland: I do not know that I can add anything to this discussion, except that the key-note to the whole thing, as I see it, is that "knowledge is power." You have to know what you are doing, what your costs are, what your efficiency is and what your heat units are going to be, before you can really increase your efficiency and find out whether the income and expenses are on the safe side. The question of whether or not you can afford to have an elaborate system has of course to be taken with modifications according to the plant. The question in my mind is, can you afford to be without a system that gives you complete information of your costs and operating efficiency?

President Oppenheimer: Mr. Culver, we have not heard very much

from you upon this subject. Can you give us a little more of your thought upon the matter?

Mr. W. S. Culver, Cincinnati: I do not believe that I have anything further to say. An incident occurs to me of a business man in a small place who had rather a small concern but was doing a rattling good business. A salesman came in to him one day and interested him in a card index system for keeping track of what he is doing. The salesman was a good talker and sold it to him. Three months later the salesman came around again and said to the merchant, "How is your card index system working?" The reply was, "Finest thing I ever got." "How is your business?" "Business is absolutely rotten." "What is the trouble? Everybody else is doing a good business around here." The man said, "It takes so much time to keep the card index system that we have not time to do anything else."

President Oppenheimer: I think Mr. Culver's remarks apply apply to the smaller companies who cannot install as elaborate a system as is presented by the Acme Power Company. But undoubtedly, where your Station is large enough to justify all these refinements you will probably get many dollars back in return for your expenditure of time and labor. The smaller companies could take the same sheets that Mr. Long presents and probably could select from them sufficient material that would not make it onerous or troublesome to keep the information whereby perhaps they culd check up a good many of the leaks and losses that they could prevent by having the proper record before them. I fully appreciate the fact that the same system of records and accounting that may be suitable for a large company is not always applicable to a smaller one and that there are possibilities of carrying these systems to extremes. I remember a case of a railway company whose system of accounting involved the cost of $2.40 to put in a ten-cent window light in a Station. That was running the accounting system to extremes. But I think that this report and the forms accompanying it will provide a nucleus or foundation whereby all companies can be governed in formulating a Station operating record where they can keep track of their operations to the fullest extent and commensurate with the kind of Station that they are operating.

There may be some others here present that would like to say

something on the subject. We would like to hear from as many of you as may have some thought to advance in the matter.

Sr. S. N. Carkson, Electrical World, Chicago: The thought occurs to me that we might get back of the forms and ask Mr. Long to tell us just what they do and what equipment they have in order to keep these records.

Mr. Wllam Long, Toledo: The number of sheets may seem to be elaborate but I think if these forms were printed and put out to the different managers of electric light properties throughout the State they could modify them for their own wants. The object of the paper is to give something to start on. The operating engineer does most of the work on the forms, it does not take a technical man; an ordinary operato- can put down the figures and get the totals. These sheets are totaled up after they come into the office and are taken care of by one clerk. They may look elaborate, but they are intended to insure a daily record as opposed to the practice of a great many Ohio properties that keep only a monthly record, for the reason that they have not the proper system that will give them the data that they require and such as is shown on these sheets. The basis of the whole thing is to get a system such that the operating man can get the proper data on the sheets. It is not the system itself, but it is the getting of the proper data that is requisite. The instruments employed are boiler meters, thermometers, gauges, that is practically all of it. The records will show what instruments are employed. The data is taken right off the boilers, the stokers, the turbines and the electrical motors in the plant. Pretty nearly every plant to-day has electrical motors. Nearly every small plant to-day has the proper instruments in the boiler-room.

Mr. Fred O. Lewis, Toledo: These forms that are used in the Acme plant are generally filled out by the men in the plant; but the costs are filled in by a girl.

President Oppenheimer: Gentlemen, can we hear from any one else on ths subject?

Mr. William Long, Toledo: I would like to have a vote by the

convention as to the disposition that will be made of the data sheets connected with Mr. Strike's paper.

President Oppenheimer: What is your thought about that, Mr. Secretary?

Secretary Gaskill: I think there are two or three good reasons why it would be well to have that published in the Monthly. In the first place, the Proceedings are delayed too much in getting out. We ought to get them published at an early date. I do not know how we are going to meet the difficulty of the large size of the reports; I would like to take that up with Mr. Strike and see if we cannot arrange it so that the reports can be gotten within the limits of the ordinary sized cuts for our publication. I think myself it is a good plan to publish the paper at any early date so that all may get the benefit of it. Besides that, if this article appears in the September or October issue of the Monthly it will give the Station Operating Committee something to work upon.

Mr. J. C. Martin, Columbus: Will it not be better to publish this in pamphlet form together with the data sheets, for the reason that some companies may want several copies of them in order to have their different employees study them and distribute them to their different departments so that they could all work on them. If it is published in the Monthly, I fear it will make the issue of the Monthly quite large and that it will not fulfill its purpose of being properly distributed among the different departments of the companies. We are all working for the good of the membership of this organization, we want to save money for our members and thus benefit them in dollars and cents. I think that we can well expend our money in putting this into a pamphlet and distributing it independently of the Monthly, and let it be done as quickly as possible; also at the same time prepare two or three sets of data sheets that will be applicable to smaller companies as well as to the larger ones. You say that these sheets can be modified; that is true, but it will require considerable ability to cut down and consolidate these large data sheets with all the minute detail contained therein to a sheet that is applicable to the smaller companies. If that can be done through the Association even if it costs a little money, and these sheets made applicable to the different sized companies and sent out attached to the article, I think

it will be for the good of all the members of the Association, the smaller plants as well as the larger ones. I am in favor of publishing the paper attaching the present sheets for the larger companies together with some others adapted to the smaller companies, and then let the whole matter go out as a pamphlet in place of putting it out as part of the Monthly, if that meets with the approval of the Secretary of the Association.

Secretary Gaskill: I do not like Mr. Martin's suggestion, for two reasons; in the first place, the Monthly would not be larger than the pamphlet, and besides the getting out of a pamphlet involves another question. The Monthly is admitted as second-class matter in the mail, and it is just as easy to insert additional leaves in the Monthly as in a pamphlet. I like his suggestion of the Committee working out simplified sheets for smaller companies, but I am inclined to say, stick to your Monthly because it is distributed at very small cost and will be in just as available form as if it were in a pamphlet by itself. We get booklets every day, especially since the war, we are getting pamphlets on every imaginable thing that you can think of, and we consign most of that stuff to the waste-basket. If you issue that in pamphlet form the first man that gets hold of it in the office will think, "Here is another one of them," and he will shoot it to the waste-basket and it will not go where it belongs. If you issue it in the official Monthly it will get to the right man. I do not take kindly to the pamphlet idea; it means larger expense and difficulty in getting it distributed.

President Oppenheimer: Mr. Long, the Chair will entertain a motion to publish all that in the Monthly. If there is a motion we can discuss it and take a vote upon it.

Mr. William Long, Toledo: Then I move that this paper with the forms accompanying it be printed in the Monthly and gotten out as soon as possible, not later than January first next.

The motion was seconded by Vice-President Howell, stated by the Chair, and remarks invited.

Mr. C. W. De Forest, Cincinnati: I think that the simplification of all those forms as used by the Acme Power Company is rather a large job and something that we cannot do very quickly. I should like to

see that part of it referred to the Station Operating Committee with the idea that they get up simplified forms as soon as possible; but that the original paper with its original forms accompanyng it be issued previous to that simplification.

Secretary Gaskill: I think that is entirely practical and a very good Suggestion.

President Oppenheimer: I think that is in line with Mr. Long's thought?

Mr. William Long, Toledo: Speaking of modifying does not refer to the entire paper. While we probably take forty or fifty coal samples and twenty or thirty ash samples, that does not mean that you are to do that in small plants. There you can take them at longer periods of time, take less samples of coal and things of that kind. I think that the forms should be printed in the way they are there and put out, and afterwards they can be modified as the Station Operating Committee sees fit.

The question was now taken on the pending motion, and the same carried, and so ordered.

President Oppenheimer: Is there anything further to come before us at this afternoon's session? If not, we will adjourn until ten o'clock to-morrow morning. I thank you all for being here this afternoon and trust that to-morrow you will be back and bring yur friends with you, and that we may have a full attendance.

Adjourned to 10:00 A. M., Wednesday, July 16, 1919.

THIRD SESSION—WEDNESDAY MORNING, JULY 16, 1919

The convention met pursuant to recess, the President, Mr. I. L. Oppenheimer in the Chair.

President Oppenheimer: The convention will please come to order. This is our third session. I believe it will be a source of gratification to the members of this Association to know that up to the present time we have registered in attendance about 350, by far the largest registration we have ever had at any meeting of this Association up to the morning of the second day. That registration will undoubtedly be increased before the convention adjourns.

The first order of business on our program is an address by William McClellan, Vice-President of the Cleveland Illuminating Company. Mr. McClellan I understand has not yet arrived, so we will reverse the order of the program and open up this morning's session with the Report of the New Business Co-operations Committee. Mr. Matthieu is going to present the Report for the Committee. Mr. Matthieu, we will be glad to hear from you. (Applause).

Mr. Matthieu now read the Report of the Commercial Lighting and Merchandising Section, as follows:

REPORT OF THE COMMITTEE ON NEW BUSINESS CO-OPERATIONS.

Commercial Lighting and Merchandising Section

The report of the New Business Co-operations Committee covering the operation of this branch of the organization for the year 1918-19 is herewith respectfully submitted.

Your committee does not feel that it should offer apologies for the unfinished condition of the work; however, a brief statement of what it had expected to do and the various obstacles which were met will be somewhat indicative of the efforts put forth during the past year.

The committee held its first meeting in Columbus, October 2nd, for the purpose of arranging the program for the year's work. The programs were assigned, two to the Lighting and Merchandising Section and three to the Power and Heating Section, the committee as a whole passing upon the subjects and speakers with the chairman of either section conducting his respective meetings, which were scheduled as follows:

Power and Heating—Cincinnati, October 30th.
Lighting and Merchandising—Toledo, December 4th.
Power and Heating—Dayton, January 22d.
Lighting and Merchandising—Columbus, March 12th.
Power and Heating—Cleveland, May 7th.

Before the first meeting could be held the influenza epidemic swept over our country and caused the State Board of Health to issue an order prohibiting all assemblies. This was followed by the resignation of the chairmen of both sections, one on account of ill health and the other leaving the industry. Later, three of the remaining members resigned.

Due to the above reverses, it became necessary to revise the schedule of meetings, with the following result:

Power and Heating—Cincinnati, December 11th.
Lighting and Merchandising—Toledo, March 19th.
Power and Heating—Columbus, April 23rd.

Your committee followed the established practice of holding a preliminary meeting on each occasion of a general meeting to arrange a program for the next meeting; also, that of allowing a small portion of time at each general meeting for open discussion of general subjects.

Probably the greatest digression from the accepted practice of selecting speakers was the decision to have all future subjects presented by men of the industry, and it has resulted in a more liberal and expansive discussion.

THE PROPOSED OHIO CODE OF INDUSTRIAL L GHTING FOR FACTORIES, MILLS AND OTHER WORK PLACES.

By F. C. Caldwell,
Professor Electrical Engineering, Ohio State University

The improvements which during the past few years, have been taking place in electric lamps have been reflected in higher illumination intensities at many points, but perhaps nowhere more than in industrial lighting. Here the natural development resulting from cheaper and better light has been greatly enhanced by the increasing appreciation on the part of manufacturers of the beneficial effect of improved working conditions upon factory output and accident prevention. A strong movement has also been inforce to impress upon production managers the importance of adequate and properly arranged lighting upon the work itself.

The Illuminating Engineering Society early saw the importance of properly directing this tendency to increase lighting intensities, as well as of assisting the movement for better industrial illumination by putting the pressure of law behind the laggards.

A factory lighting code was therefore prepared by the lighting legislation committee of the Society, and after thorough discussion and much revision, first published in November, 1915.

In the fall of 1916 the speaker took up the matter of an industrial lighting code for the State with the Industrial Commission of Ohio, and met at once with a cordial response from the Safety Director of the Commission, Mr. V. T. Noonan.

The time was ripe for the work in this state because through recent action by the Legislature, the Industrial Commission has been empowered to have prepared and to promulgate as law such industrial codes as in their judgment were needed to safeguard the lives and health of the industrial workers of the state.

For the preparation of these codes the Commission adopted the plan outlined below. A general advisory committee was appointed to have charge of the work, and to recommend codes to the Commission. This committee was made up of representative employers and labor

leaders. It in turn, was authorized to appoint committees similarly composed to draw up and present to the general advisory committee specific codes. All these committees gave their services without remuneration. Such a committee is responsible for the present form of the proposed factory lighting code. Its personnel is as follows:

S. E. Doane, Chief Engineer, Eng. Dept., National Lamp Works of the General Electric Co., Cleveland.

O. W. Walker, Secretary of the Committee, Representative of the Cooper Hewitt Electric Co., Cincinnati.

J. J. Graney, Ohio Federation of Labor, Youngstown.

T. J. Donnelly, Secretary, Ohio Federation of Labor, Columbus.

H. L. Jenkins, Superintendent, Holophane Glass Works, Newark, O.

H. H. Craiglow, Engineer, Buckeye Steel Castings Co.

F. C. Caldwell, Chairman, Professor Electrical Engineering, Ohio State University.

Much credit is also due to H. H. Magdsick, Engineer with the Engineering Dept., National Lamp Works, General Electric Co., and to J. G. Adams, First Asst. Deputy of the Division of Workshops and Factories, who have co-operated with the committee.

It has been the policy of the Commissioin to proceed very carefully in the building of its codes and even after they have been adopted not to promulgate them as "general orders" until the industries have had ample time to adapt themselves to the new conditions. In this way, thoroughly workable codes have been produced with comparatively little opposition from manufacturers.

The procedure in code building has been as folows. After the committee has held meetings and evolved a set of rules which seem satisfactory to itself, the code is printed and distributed to an extended mailing list of industrial companies. These are invited to send representatives to discuss the code at public hearings held at various cities throughout the state. These hearings are a very useful factor in the code building, and generally result in many changes. A second edition of the proposed code is now printed and a series of final hearings held. With all the evidence now before it the committee prepares its final report on the code and presents it to the general advisory committee. If this committee finds the work good, it in turn recommends it to the Commission. The Commission is now likely to adopt the code as standard for inspection by the factory inspection department and to continue

its use in this form for a year or more before its final adoption and promulgation as a general order when it becomes a part of the laws of Ohio.

It will be easily understood that while code building under the above procedure is slow, it ought to be sure, and the code should therefore be ready for action by the Commision within a few months

Proceeding now to a consideration of the code itself, it will be noted that the code proper is brief, consisting of only four short rules, but that these are accompanied by a very long appendix. This form was the one used by the I. E. S. in its original model code, and has been followed more or less closely in most of those which have been drawn up since. The need for this long appendix is mostly found in the general lack of knowledge with regard to the principles of illumination. The situation here is very different from that found in the case of most safety codes, which deal with matters that are fairly well understood by those who have to handle them.

The Ohio code proper is based upon the I. E. S. Code and corresponds quite closely with its latest edition, but the appendix differs widely, and is, the committee thinks, improved. Our committee takes credit to itself for having been influential in some important changes in the later edition of the I. E. S. Code.

Let us next consider in detail the provisions of the Ohio Code.

Rule 1. This being in the nature of a preamble only, requires no discussion.

Rule II. This rule establishes a series of classes or grades, each calling for a different intensity of illumination. Into these different grades the various industrial operations must be fitted, their proper classification being based upon experience, or when that is lacking, upon the judgment of lighting experts. This, at least in a provision day, the committee has done in section 6 of the appendix.

It is hardly to be expected that the whole of this classification of industrial lighting requirements,—the most extended ever undertaken,—will be without error, but where experience with the use of the code shows that changes are needed, all that will be necessary will be to move the operation in question to the next higher or next lower grade.

It is to be remembered that this code is a safety code, and that the intensities specified are therefore not those that would be recommended for the best results from the point of view of production, but are the

minimum allowable for safety from accident and for the health of the eyes. To avoid making it appear that these minimum intensities are recommended as illumination standards, the second column of "preferred values" is appended.

Rule III. It is unfortunate that in the present state of the science of lighting, this rule does not admit of such exact statement as does Rule II. The prevention of glare is nevertheless of as great or perhaps greater importance than the maintenance of adequate intensity. It is true that the Wisconsin code does undertake to make rather exact specifications for this matter, and their rule has formed the basis for the suggestions contained in section 8 of our appendix. On account of the relatively smaller number of industries, the enforcement of such a rule is probably simpler in Wisconsin than in Ohio. At any rate, the Ohio committee was disposed to let Wisconsin try it out first.

Rule IV. This rule, as it were, sums up the other important phases of good lighting not included in Rules II and III. Perhaps the most general criticism that has been brought against the code is its lack of definiteness. It is to be hoped that with the further advancement of the science of lighting and after experience in the enforcement of lighting codes, more exact rules will be developed. Indeed, some advancement, as indicated in the elaboration of sections 6 and 8 of the appendix, has already been made in the three and a half years since the I. E. S. code was first published.

That light can be expressed quantitatively and easily measured with a fair degree of accuracy seems to be almost unbelievable to the average man. It is fortunate therefore, that comparatively inexpensive and easily read instruments for measuring illumination in foot-candles are now on the market.

A brief discussion of the appendix is next in order. In the Ohio code this fulfills two rather distinct purposes, the first educational, the second, advisory as to the carrying out of the code rules. It may be expected that this latter material will be eventually incorporated in the code itself. Indeed, there has been some feeling that section 6 should be made a part of Rule II from the beginning.

The first five sections of the appendix are strictly informational, defining the most important terms used in connection with work on lighting.

Section 6, Light Intensity, is of course a very important one, giv-

ing as it does a schedule of factory operations classified by industries, with the grade which has been assigned to each by the committee. The minimum and the preferred values of intensity for the given grade are also included for the convenience of the reader. The committee is appreciative of any suggestions from whatever source looking to the improvement of this table.

Section 7, character of illumination, calls attention to glare, diffusion and color as characteristics of lighting. Section 8, on glare as indicated above, is a very important one. It undertakes to give such information with regard to glare as will permit the successful enforcement of Rule III of Code, that is, it is one of the advisory sections. Sections 9 and 10, dealing with distribution and diffusion and are advisory to Rule IV. Section 11 deals briefly with color and Section 12 sums up the principles of good lighting.

Sections 13 to 22 have to do with daylight and its proper use. It will be noted that the code rules apply to this as well as to artificial light.

The remaining twelve sections of the appendix are all informational in character and take up briefly such subjects as "The value of good illumination," "Accident prevention," "Location of lighting units," "Lamp accessories," "Maintenance," "Cleaning and inspection," and so on.

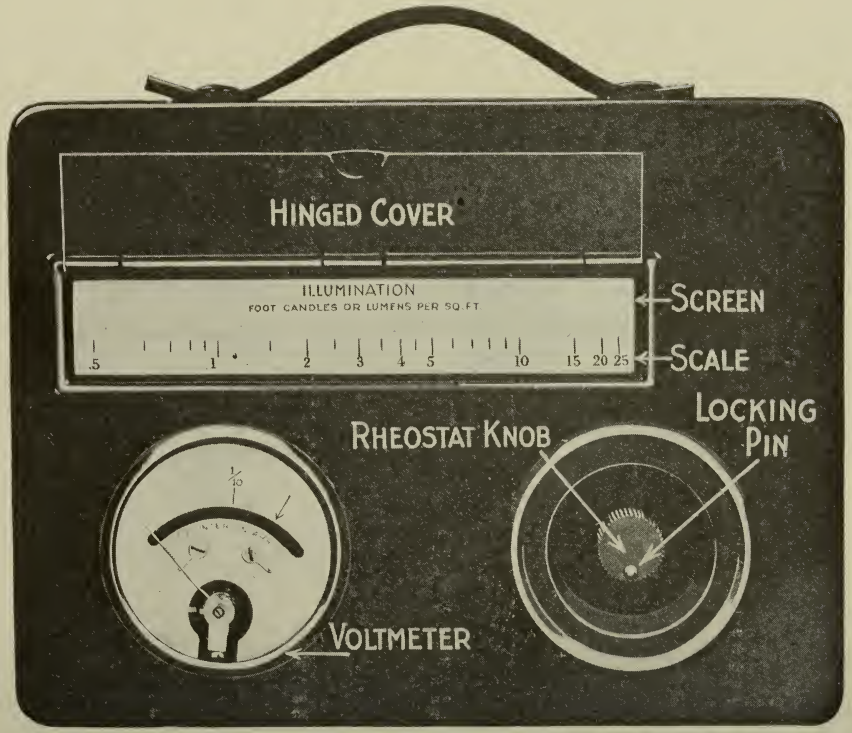
Before closing I wish to be sure that the present and future status of the code is fully understood. While the code will probably be adopted in much its present form, it is still subject to revision by the committee. After final action by the committee, the General Advisory Committee has to consider it and then if it meets with their approval, it goes to the Industrial Commission. The Commission, it is hoped, will establish it as a standard for inspection by the Division of Workshops and Factories. This means that whenever the factory inspectors find bad lighting conditions, "special orders" will be issued for the improvement of the same in accordance with the code. It should also mean that all new work and all reconstruction will be done according to the provisions of the code. Also all industrial companies should be looking into their lighting and bringing it up to code standards.

After a year or more of such experience with the working of the code, it will presumably be revised again and then finally promulgated as law by the Commission.

Seriously, the code should find in no class of people, more cordial

advocates than among the members of our society. Nor do we need to look at each provision of the code from the point of view of the sale of current and its effect upon dividends. We are The Ohio Electric *Light* Association, apostles of good lighting from the beginning. Every movement looking toward better lighting deserves, and I am sure will receive, our hearty support through every means at our disposal.

Mr. S. E. Doane, Chief Engineer of The National Lamp Works, Cleveland, emphasized the fact that Central Station representatives should become thoroughly familiar with the code, in order that they may educate their customers to the correct interpretation of same. He also demonstrated an instrument known as a foot-candle meter (see Fig. 1) for indicating the intensity of light at any particular point on a plane. The simplicity of this meter will permit the layman to check the intensity of illumination in his store or factory wthout resorting to the usual method of calculation.



Foot Candle Meter.

"HAS DOMESTIC REFRIGERATION PASSED THE DEVELOPMENT STAGE?"

By C. C. Henderson
Toledo Railways and Light Co., Toledo, Ohio

The answer to this question should interest every man in the Central Station Industry. The act of artificial refrigeration has been known in one form or another for a long time, but commercialized mechanical refrigeration only dates back to 1870. From that time up to the present, patents have been issued on many mechanical refrigerating systems, 95% of which have proved to be failures; however data submitted by Mr. J. N. Hadjisky, Chief Engineer of The Kelvinator Co., Detroit, Michigan, and Mr. C. C. Spreen, Chief Engineer of The Frigidaire Corporation, Detroit, Michigan, would indicate that "Domestic Mechanical Refrigeration has passed the development stage."

Many features of the above mentioned machines are not unlike. Both use sulphur dioxide as a frigerant, it being non-explosive, non-inflammable, non-poisonous and is real efficient. Both systems are thermostatically controlled. When the temperature reaches a predetermined point, the motor driving the compressor is automatically started by the closing of a switch and continues to operate until the desired temperature is reached when the thermostat opens the switch and the operation ceases. The compressor of each machine is driven by a ¼ H. P. motor, consuming from 200 to 300 watts per hour, depending upon weather conditions. The compressor of the Kelvinator is air-cooled water connection. The 'Frigidaire" system includes the cabinet or box while that of the "Frigidaire" is water-cooled, requiring a ¼-inch while the "Kelvinator" is adaptible to any well constructed cabinet. Both machines carry guarantees and service is the keynote.

At the present price of such apparatus it is estimated that between 5 and 10 per cent of American families can afford domestic mechanical refrigeration. Quantity production will tend to decrease prices and put them within reach of 20 to 25 per cent.

Central Station men already recognize the refrigerating machine as a desirable load; its advantages as a day load instead of a night load,

and summer load rather than winter load. It is a load that can be carried without increasing the fixed charges upon the plant and distribution system in general.

With the mechanical refrigerator we substitute the central station man for the ice man, the electric and water meters for the iceman's scales and also eliminate his dirt. Sanitary methods have most distinctly been impressed upon us in recent years, and the danger to health in deteriorating food is a constant reminder for care in its handling.

C. G. Eichelberger, *Chairman.*
W. P. Whittington,
E. F. Schmidt,
J. R. McCoy,
Jas. L. Stone,
Committee.

Mr. Matthieu also read the Report of the Industrial Power and Heating Section of the New Business Co-operations Committee, as follows:

INDUSTRIAL POWER AND HEATING SECTION OF NEW BUSINESS CO-OPERATIONS COMMITTEE REPORT.

The success of our two meetings during the past year under trying conditions was entirely due to the co-operation of all members of both sections, some of the new members having displayed active interest and assistance in the preparation of programs, which proved to be a difficult task due to the illness of many and general unsettled business conditions, added to several changes in our organization. However, both meetings were fairly well attended and a lively interest displayed by those who attended, in the very excellent papers presented upon subjects assigned.

Our first meeting at Cincinnati on Wednesday, December 11, following the Station Operating Committee meeting on December 10 and preceding the Transmission and Distribution Committee meeting on December 12, was attended by several members of other committees who assisted in the discussion of subjects which no doubt proved helpful to all.

At the morning session of the Cincinnati meeting a paper upon the subject of Industrial Electric Heating to Replace Present War Contracts, written by W. D. Scott of Pittsburg, was presented by Mr. C. A. Cramer of Pittsburg. Mr. Scott being unable to be present, this paper, although assigned before the Armistice was signed, the subject of importance to nearly all power companies proved to be of unusual interest, being discussed by Messrs. Matthew, Hoover, Whittington, Oppenheimer, Crippen, Kelley, Wilkinson and others, resulting in a sub-committee being appointed, composed of Messrs. Hench, Matthew and Eichelberger to take charge of this branch of the work, gathering and distributing heating data, etc. Nothing was accomplished along this line because of Mr. Gaskill having experienced some difficulty in financing the additional cost of this work, although several manufacturers, including the General Electric Company have had special Industrial Heating literature prepared for distribution by the committee.

Afternoon Session.

Improvements in Power and Load factors, presented by Mr. C. I. Crippen, power sales manager of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, in a very thorough and comprehensive man-

ner proved to be both timely and interesting, resulting in much instructive and profitable discussion, opened by W. S. Culver of the General Electric Company and A. C. Shepherd of Cleveland. Although Mr. Crippen's paper was published in our Association Monthly, March issue, we are including it in this report.

Second Meeting at Columbus, Ohio, April 23, 1919.

Morning Session.

Recent Developments of Industrial Heating, by Mr. R. T. Kaighin of The Cleveland Electric Illuminating Company, with discussions classified as follows:

Brass Furnaces. A discussion on Brass Furnaces was opened by A. E. Rhoades of the Detroit Electric Furnace Company. Mr. Rhoades went into the details of the operation of his furnace, which is a rocking type, the principle being that of the indirect arc, and the rocking is to agitate the metal in order that the heat may be uniform, and at the same time all openings sealed, thus making the furnace air tight. The cycle of rocking motion is once in 33 seconds. The furnace requires about 210 Kw. h. per ton of metal, the average time per heat of one hour. The size furnace being built by this company will be 500-1000 and 2000 pounds, respectively, requiring 75 Kw., 150 Kw. and 300 Kw. respectively.

The red brass will require from 265 to 275 kw.h. per ton. The Power Factor on this furnace is from 85 to 90 percent and is made for single phase operation only, requiring 4" electrodes, and with an average reactance of 18 percent.

Low temperature heating was discussed by Mr. Reed, of Young Bros. Company, Detroit, who went into the Japanning and core baking proposition in detail, giving a lot of statistics relative to ovens, etc.

Heat Treating was very ably discussed by Mr. Chas. Foster, of the Electric Furnace Company, Alliance, Ohio, who gave us moving pictures views of heat treating ovens now in operation. This subject was very ably presented, and disclosed the enormous future that can be expected from the electric heat treating ovens. The principle point of interest was the uniformity of the product which they are able to obtain, thereby cutting down rejections very materially.

Mr. F. Von Schlegell, of the Industrial Electric Furnace Company of Chicago, discussed the problem of demands, rates, etc., that have been

brought about since the signing of the armistice. It is a recognized fact that most of the steel companies using electricity were, during the first month after the signing of the armistice, burdened with very high electric bills, due to the fact that they cut out night operation, necessarily bringing their rate per kw. h. almost to a cost where use of the same would be prohibitive, in melting of steel electrically. It was clearly brought out that the Central Stations could not reduce rates to meet this condition, and that the cycle of operation would have to be changed in the future. This has been done by some companies. This is a proposition which will have to receive very serious consideration from the standpoint of power companies and steel manufacturers.

The condition referred to by Mr. Von Schlegell has largely righted itself because of most industries having since speeded up and are now working full time which automatically reduces this unit power cost in proportion to the hours of use.

Afternoon Session called at two o'clock. Subject, "Application of Electric Welders and the Proper Return for their current consumption," presented by C. I. Crippen, Power Sales Manager for The Mahoning & Shenango Railway & Light Company, Youngstown, Ohio.

Discussed by C. E. Speer of The Lincoln Electric Company, Cleveland, Ohio. Mr. Crippen and Mr. Speer presented us with much valuable and interesting information, but due to the inability of a number of others to attend this meeting, who were to have participated in the discussion, there was little said upon the subject in addition to that supplied in able manner by Mr. Speer. This meeting adjourned at four o'clock P. M., closing this sections business for the year.

Recommendations.

This Industrial Power & Heating Section suggests the following for the coming year:

First, that a Committee of five be continued as members of this section.

Second, A continuation of joint meetings with the Commercial Lighting and Merchandising Section.

Third, A continuation of Committee conferences at the larger cities.

Fourth, the continuation of the plan of having preliminary Committee meetings the night before the day set for the public meeting or conference, for the purpose of preparing program and details for the next meeting.

Fifth, that subjects are assigned to, prepared by and delivered by active

or central station members and discussions by manufacturers, engineers and salesman.

Sixth, that a public stenographer be engaged to report proceedings and discussions at each meeting for records and the benefit of members, who do not attend these meetings.

INDUSTRIAL ELECTRIC HEATING TO REPLACE PRESENT WAR CONTRACTS

By Wirt S. Scott

Manager Industrial Heating Section
Westinghouse Electric & Mfg. Company, East Pittsburg, Penn.

Conservation of materials has become a keyword in this country since our entering into the world war, and while this truth was brought out very forcefully it necessarily became subserviant to a more important demand--production. It was realized in many cases and not without concern that a saving, either in the raw material or finishes product, could be made if the method of production could be altered, but due to the extreme urgency of the case, it was not permissible to do anything that would interfere in the least with the production, hence all such projects necessarily had to be deferred until a more opportune time.

Now that the war is over, attention is again being directed to these propositions and the indications are that the time has arrived for the installation of labor-saving, energy-saving and material-saving devices on a scale heretofore unthought of.

There is no single development which presents the possibilities for conservation of energy, labor and material as made possible by the development of electric industrial heating. Electric heating can be incorporated with labor-saving devices in many ways impossible with any other method of heating. The proper application of electric heat, together with the methods of control, results in higher grade products, elimination of rejected material by correct method of heating and a saving in materials due to the ability to apply a non-oxidizing heat to the material to be treated.

The remarkable increase in the industrial electrial heating load, particularly that made possible by the low temperature applications, has resulted in some of the larger electrical manufacturers and central stations making surveys of the field, in order that they may know in a general way the prospective business in sight, or the business that may reasonably be considered

obtainable, provided the necessary electrical equipment is available to supply the heat in the manner and at the temperature required.

Those who have had an opportunity to study the situation within the past year are unanimous in their conclusion that the central station industrial heating load ultimately *will equal the motor load.*

All indications point to a very rapid increase in the amount of power used for electric heating. One large managing corporation operating over quite an extensive terriotory in this country has made a very exhaustive survey of all power users in their territory, consisting of customers and of prospective customers, of the present power consumption, motors and heat, under present operating conditions, also on the basis of complete electrification. These reports show that the *available heating load* compared to the *available motor load is three times as great.*

Assume that the heating load ultimately will only equal the motor load, instead of being three times as great. It has been but a few years ago since we spoke of lighting plants and correctly so. Why? Because the lighting load at night was the main load and the motor load was an off peak load, consequently the entire plant's operation centered around the lighting load. Within a short period a complete reversal has taken place. The motor load is not the main load and the lighting load the off peak load.

The present development in the motor load is not due so much to the fact that electric motive power is productive of greater economy and reliability of service, increased production and ease of operation, as it is due to the fact that a demand was created for the use of electric motors by the presistent and combined efforts of the central station and electrical manufacturer. If the electrical men will devote the same energy to the development of the industrial heating load as was done in the development of the motor load, we will put across in less time a much larger proposition; the load which ultimately will be the main consideration in the location and design of power plants, and, wholly unlike the lighting load or present motor load, in not having enormous peak periods with plant equipment standing idle from eight to sixteen hours out of each day.

The industrial heating load is not a load which will necessarily come on top of the motor load. At present many of the power plants are struggling along during the day to carry the motor load, while at night the load is relatively small. In the majority of cases the heating operations in an industrial plant may be carried on entirely independent of all other operations, conse-

quently in addition to the certainty of securing this enormous load there is also the possibility of having this load regulated so as to come on the power plant at all the valleys in the power curve.

The indusirial heating load is so diversified that it is possible to find a load which will fit in any valley of any power curve. Even the noon hour off peak period can be utilized for some specific operation which can be done at that time just as well as at some other period.

Many cases have come to our attention recently where the customer who was willing to electrify and had been turned down by the central station on account of the overload condition of the power plant during the day time, jumped at the chance to operate at night. In every case it had not occurred to the customer that the central station possibly could supply the necessary power during the night, or that he could perform his particular heating, operating at night just as well as during the day, and at a much less expense, since the fixed charge for the power in many cases was taken care of by the day load, the night load being obtained on a straight energy cost basis.

In the development of the motor load it was necessary for the central station to have specially trained men who could talk intelligently to the prospective customers and who had sufficient knowledge of motor application work to be able to secure the necessary data, so that either by his own knowledge or through a source of information he knew to be available, either in his own organization or in that of an electrical manufacturing company, he could go back to the customer with the correct answer. Just as this was true of motor application work, so it is true of industrial heating.

In order to develop the industrial heating load a vast amount of missionary work must be done and the sooner these initial stages are passed just that much sooner will the central stations begin to reap the benefit of their efforts. But to do missionary work, one must have something definite to exploit and in this case there must be apparatus available for applications with which the power solicitor will come in contact. Several of the larger electrical heating companies have formed industrial heating departments for the development of industrial heating, and are bending their efforts in the development and manufacture of new and suitable apparatus. New ideas and applications are springing up so rapidly that it is now a matter of selecting only those that offer the widest field. However, those applications that appear special today may be placed in a general class tomorrow, and the apparatus developed for some specific application perhaps may be used in very large quantities in applications altogether different from that originally intended.

The three fundamental properties possessed by the electrical method of heating, making this method of heating far superior to that of any other method, may be attributed to the following:

Application:

The electrical heaters, in whatever form they may take, can be applied directly to the object to be heated, at exactly the proper temperature, and in sufficient capacity to produce the best results.

Control:

By means of suitable control equipment the object to be heated may be maintained at any desired temperature continuously and entirely automatically as long as may be desired. The permission combinations for flexibility and refinement of control are almost unlimited.

Efficiency

The fact that the electric heaters do not require air for the proper produbtion of heat as is the case with oil or gas, makes it permissible for the heaters to be applied directly to the object to be heated. By means of suitable insulating material, properly applied so that practically all of the heat generated will be conducted to the material or object to be heated, a very high thermal efficiency is obtained. This is impossible with gas, oil or coal fuel, since only a small percentage of the heat is utilized, the larger percentage of heat escaping in the fuel gases. This difdifference in the efficiency of the *utilization* of the heat by the electric and the combustion and methods of heating, is the reason why the electrical method can complete with the combustion method on a straight B. T U. basis even when the cost for a given quantity of heat is in order of ten to one in favor of the combustion fuel.

In the determination of the amount of power required in any heating process, there is certain amount of general information to be secured before an intelligent calculation can be made as to the kilowatt hours and the kilowatt demand necessary for a satisfactory application.

1. The material or work to be heated is the first point to be considered. A given kind of material requires a definite amount of power to raise the temperature of that material one degree Fahr. The specific heat or the power required to raise the temperature of a material one degree Fahr. have

been determined for nearly all materials in use; hence, with complete information supplied as to the kind of material to be heated, one of the factors in the heat calculation has been supplied.

2. The initial temperature of the material or work, the maximum temperature and the final temperature to which it will be heated:

By initial temperature, is meant the temperature at which the material is placed in the oven furnace or container to be heated. This may or not be room temperature, depending upon whether or not the material has previously been heated, and has had an opportunity to completely cool off. The maximum temperature is that required to produce a certain chemical change or a certain result in the heating of the material. The final temperature often is the maximum temperature, but not necessarily so. Bearing in mind that the power required to heat a given piece of material, neglecting for the moment all other losses, depends upon the initial and the final temperature, or the temperature range a piece of work will enter a continuous oven or furnace at some initial temperature, be heated to a maximum temperature, then before leaving the oven or furnace, be subjected to a cooling, by entering a chamber in which no heat is applied or by blowing cold air over the work. In either case a certain amount of heat which the material previously has absorbed when subjected to the full force of the heat will be given off in the oven or furnace, and utilized in preheating the work entering the oven or furnace, or may be used in supplying part of the heat required to maintain the necessary temperature. In such cases, as far as heating the material is concerned, the power required will depend upon the initial and the final temperature.

3. The size of the oven, furnace or container: With a given exterior surface temperature, the power lost through radiation will be proportional to the exterior exposed surface, hence greater economy will be secured by leaving the container as small as possible.

4. The kind of material from which the container is made: The radiation losses depends upon the rapidity with which heat is conducted from the interior surface to the exterior surface of the container. Steel conducts heat 1000 times as fast as a high grade magnesia or diatomaceous earth, hence, one square inch of steel extending from the inside to the outside of the container will conduct as much heat as seven square feet of high grade

insulation. The importance of eliminating bolts, rods, etc., extending through the container walls may thus be appreciated.

5. Thickness of container walls. With the heating done within the interior of the container, the rate at which the heat will flow through the walls will be inversely proportional to their thickness. If the losses are a certain value with container walls of a certain thickness, the losses will be reduced to one-half that value if the thickness be doubled.

6. Weight of movable and immovable racks, trays or trucks within an oven or other container, and the initial temperature of same:

These accessories absorb here just as much as to the work, therefore, in order to determine how much power is expended in the heating of such parts, the weight and initial temperature must be known. It is desirable to have as light racks and trucks as can safely be used, also, to maintain them at as high a temperature as possible when not in use by keeping them in the oven with the doors closed when not in use, or by returning them to the oven as quickly as possible.

7. The length of time the oven, furnace or container is out of operation between heats: All substances absorb heat, hence the walls of an oven, furnace or container will absorb a definite amount of heat in a definite temperature rise. The amount of heat initially absorbed by an oven may easily be three or four times that required for the work. If the oven is allowed to cool off completely after each operation, an enormous amount of heat if lost in proposition to that utilized. A heating installation should be designed so that a maximum amount of ovens will always be in use, and that when ovens are not in use they may be kept entirely closed.

8. The amount of ventilation required: In many baking and drying processes a certain amount of ventilation is necessary either to supply the oxygen required by the chemical change undergone in the heat treatment, or to hasten the evaporation of moisture. The air usually enters at room temperature and is discharged at the maximum oven temperature. Seldom does the customer know the amount of ventilation he is using, or the amount required to produce the best results.

9. The amount of moisture to be evaporated: In a drying process, the

work may be partly saturated with water, such as in the drying of powders, woods, leather, etc., or a thin film may cover the surface such as enameled or japanned products which are cleaned in a pickling tank, rinsed in clear water, and run into an oven for quick drying before being dipped in the enamel. Incidentally, this method has another advantage in that in evaporating the moisture, the work is also heated, so that upon being dipped in the enamel, a better flow on the material is obtained, the dipping period reduced, the consumption of enamel reduced, and a better finish secured. The moisture may be evaporated by direct heating, or by the heating of a large volume of air which is caused by the work absorbing the moisture.

The application of heat to any specific machine, apparatus or material should be made with a definite object in view, the application may be made with the object of obtaining a specific result in the working of fabrication of a certain material, or it may be made solely for the purpose of reducing the cost of the heating operation. In accomplishing the first, it does not necessarily follow that the second will or should follow, but to accomplish the second it necessarily impulses that the first also will be attained.

To obtain a definite operating result in the working or fabrication of material, a study of the specific heating operation must be very thoroughly and very carefully made to insure success.

For an application to be a success in the true sense of the word, reference is not only made to the material being treated, but to the apparatus by means of which the heating is accomplished, as well. Furthermore, it should not be the object of the investigation to duplicate the results which are already being obtained by present methods, but to produce a *better* product.

In many cases, an improved product is secured by means of electric heating at a less cost than that required to produce an inferior article by other methods of heating, on the basis of fuel costs along. However, the first consideration should be a successful application, with all it implies, regardless of the comparison of the fuel and power bills, which, by the way, does not tell the story by half.

If, in the use of electric power, the object is to obtain greater economy of operation, the investigation extends to the present cost of operation, the cost of electric power when substituted for the then existing method of heating, the value of a better product to the manufactured, making an analysis of process of manufacture for the purpose of placing the heating equipment at a logical point best suited to fit in with the natural sequence of operation,

and in the working out of a scheme or system whereby the amount of labor required will be reduced to a minimum. Electric heat can be very highly advantageously employed in this respect.

In many cases, the value of the improved product along is sufficient to justify the use of electric heat. It can be applied in the most advantageous manner, thereby laying the foundation for securing the best results The rate of heating can be exactly regulated, and correct operating temperature can be obtained and *maintained* continuously and entirely automatically throughout the entire heating operation. The difference in the value of an inferior product due to improper heating, as compared to a high grade product resulting from proper heat treatment will often make the cost of power entirely negligible.

The advantages derived in the use of electric heat depends somewhat upon the specific application. It is often the case that a great saving is obtained in an unlooked for manner. Among the most obvious reasons for electric heating may be listed the following:

Electric heat is clean.
There are no objectionabie gases to vitiate the air.
There are no products of combustion to collect on the work.
Elimination of fire hazard.
Ease of operation.
Heat may be applied in the most economical and direct manner.
A definite rate of heating can be established and these results reproduced in successive operations.
The temperature may be automatically maintained at the desired operating point.

Electric heating permits of experiments being made to determine the best method for applying the heat, the proper rate of heating, and the maximum temperature permissible for obtaining the best possible results. And since these factors have been determined, to enable an operator to reproduce these results day after day in the shops, in the working or fabrication of materials.

Without attempting to prophecy, but taking the conditions and analyzing them as they appear to date, it would seem that now that the war is over-the industrial plants throughout the country will find themselves over-motor, ed, with a result that there will be a falling off in the central station load.

If this falling off does not occur, certainly there will be a long period in which there will be no marked increase in the loads produced by the addition of motors on central station lines.

It is during this period that the central station as well as the electrical manufacturing company will need the industrial heating load. It is up to the central station to thoroughly acquaint themselves with what has been done in the past in the way of industrial electrical heating, organize themselves so as to make an analysis of the prospective business in their territory, determine the nature of the application, the business involved, and to confer and co-operate with the electrical manufacturing companies for the purpose of having suitable equipment developed at this time to meet the applications of a later date, and for the utilization at the present time of equipment now developed and on the market.

IMPROVEMENT OF POWER AND LOAD FACTORS.

By C. I. Crippen.

This matter of Power Factor and Load Factor has been before your body on various occasions and there is, perhaps, a wealth of information on hand in the way of reference works and other data but it would seem that the importance of these two factors in Central-Station operation cannot be over emphasized. The stress which has been brought to bear on the power companies during the period of the war has shown clearly to many of us what poor power factor and poor load factor mean. We are inclined to consider these two ratios in rather an abstract way, knowing that they are parts of problems with which we have to deal but not looking at them as things for definite study and prompt disposition. To a great many stations the demands of war production have shown up deficiencies and those who have been obliged to face serious situations of poor power factor and low load factor now will appreciate as never before just what an important part they play in central-station operation.

The Commercial Department of the power producing Company, be it large or small, is operated for the prime purpose of marketing the company's product at a profit. Profits are of various kinds, real, apparent, intangible, negative, etc. but the only variety of profit which links up with a successful commercial organization is "real." To make certain that the product is being sold at a real profit cost items are required and while the two factors under discussion are perhaps not as important as several other expenses yet

they are frequently over-looked or neglected. The industry in which we are engaged is constantly growing and the work of today, well done is the foundation for profitable expansion development of tomorrow.

Failure to meet the situation due to power factor and load factor now may mean serious embarrassment within the next few years, such oversight may correspond to the difference between the real and apparent profits or even between real and negative profits.

The function of the Central Station is to render a maximum service within the territory which it serves; in return for the service given the successful company earns a fair return for its stockholders. The Commercial Department is largely responsible for the proper performance of this duty and also the payment to the company of a revenue which is both equitable and sufficient to produce the fair return on the capital invested. The proper understanding of the subjects of load factor and power factor are surely essential to the successful company, hence to the commercial department with its man or men.

Those notes are not prepared as an engineering treatice on the subject but as the means of presenting an ideal to Central Station Commercial men. The thought which I shall attempt to convey is in the nature of a reason for the determination and building of a policy which will grow and broaden with experience. Time does not permit of a complete analysis and discussion of these two subjects, which are quite alike in some respects and wholly different in others so we will therefore pass over rather briefly points which apply but are already well understood. Taking up first the matter of power factor.

Getting back to fundamental principals we say that the total current is an alternating current circuit may be considered as made up of two component currents, one in phase with the voltage of the circuit and capable of per forming mechanical work, and a second which departs from the voltage of ninety electrical degrees and is therefore not useful in doing mechanical work. This ninety degrees component we freakenly termed the reactive current. Inductance in the circuit tends to cause the ninety degree component to lag with reference to the voltage while the effect of capacity on the other hand, tends to cause this component to lead the voltage. By the term Power Factor we indicate the amount by which the total current lags or leads the voltage. The term power factor being employed to indicate the coincidence of current in voltage.

In the average case of our present day Central Station the condition to

be considered is one in which the current lags the voltage commonly spoken of as (low power factor). The analysis of the individual loads connected to the system will show the principal cause of this condition to be underloaded transformers and induction motors. Years ago was stations operating for lighting purposes, power factor could be and was neglected. As the inductive load has increased the power factor has lagged, and will continue to do so as this inductive load grows.

The commercial representative in writing contract for motor service with a power user has established himself favorably in the mind of the user long before the agreement is signed; he is in the most excellent position to suggest to the consumer the use of equipment which would give power factor values and in many cases the company makes a practice of doing much engineering work for the consumer who is not equipped to handle electrical problems. This is a golden opportunity to show definitely and conclusively the good power factor pays and that the advantages are mutual between consumer and company.

Frequently we meet the user who can see that it is beneficial for the Company to operate at high power factor but does not agree that the same line of reasoning applies to his own installation. The commercial man must be well versed in this matter that he can convince the consumer in the beginning and keep him convinced through years of operation.

The company's business is the sum total of the business which it does with the consumers. Business depressions which affect the consumers are directly affected in the company's statement, the bond is close and in like manner the user is dependent on the company for first class service; therefore any condition which affects one affects another. If the user of power is at perfect liberty to employ the service in any he may choose, it is easy to picture the condition which might result; printed rules and regulations are provided to guide the consumer in his utilization of these services but there is still further directing to be done which is usually in the form of kindly advice and suggestion.

When the consumer sees that economies for the Company are savings for him, that a real community of interests exists, much good will have been accomplished. Rates for service are competative for the service from the Central Station must be so priced that it can be employed to advantage over energy from private plant or other source. If this is not true, contracts will be short lived and the use of service generally unsatisfactory. Aside from

the power of the regulative bodies the rates must be at the minimum level consistent with good service and the proper maintenance of the property, physically and financially, for the rendering of such service. A consideration of the simple principals of good business convince that future growth and development are not to be expected if present day practice leads to distrust on the part of the user.

A pontoon bridge is composed of small boats on which a super-structure rests, as a unit this bridge serves a useful purpose when load crosses the bridge the combination of boats and platform combine in the proper manner to support the load, each individual part performing its function. A small lead in one boat reduces its buoyancy and it ceases to carry its full share of load, thus imposing extra duty on the other boats and superstructure; as the leak increases the boat tends to sink, not even sustaining its own weight and it becomes a menace to the whole bridge. Enough leaky boats and our structure collapses. In somewhat similar fashion, conditions detrimental to the company's efficiency as produced by one consumer must be reflected in the company's position toward other users. To be sure it is difficult to analyze the problem exactly and to work out and apply differentials in rate to cover every variable in the cost of service but we can easily bear in mind that equity in a practical sense should prevail and that those consumers who create unfavorable conditions must either correct these conditions or pay a sufficiently higher rate to compensate for the extra burden incident to their load.

Each property presents individual factors which must be considered carefully in attempting to set us working standards, the value used by one company may not apply correctly to another system of similar general characteristics. For instance, the generators of one company may be rated to develop full load at unity power factor while in the next case the full load rating may be at .80 power factor. One company may have very little, if any, synchronous capacity which it operated thus having practically no direct control of the power situation, while another system, having a large street railway load for example, may have sufficient synchronous capacity to be able to regulate the system power factor to a very great degree.

At any rate, a thorough study of each system should be made, taking recognition of the increases made for the past several years in various classes, of load, and also, the variety of load which may reasonably be expected as the system continues to grow. In a system where there is a prevailing type of load which inherently runs to large motor units with good load factor it

is logical to expect the task of maintaining a good operating power factor would be much simpler than in a case where the total load is made up of a large number of small users whose typical load is the small induction motor running at varying loads. In this connection we must recall that the lighting load is naturally of high power factor and in a well designed system takes care of itself. The result of this study should be the setting up of certain standards of power factor and the foundation of a policy which will bring the actual operating power factor up to the desired point.

The next logical step in our program for good power factor is one of education. The company employee, particularly the commercial man, must thoroughly appreciate the advantages to be gained by both company and consumer, through good power factory conditions. The subject must be so well understood that every installation, new or old, is instinctively analyzed and classified as being up to standard, above or below. With the company's representative thoroughly saturated with this idea of good power factor he unconsciously transmits to the consumer the same line of thought to the end that the princible is gradually spread throughout the consumer's organization as well as that of the company.

A good working knowledge of the power factor characteristics of the usual equipment is essential, and this data is used as the basis of forming an opinion as to the resultant power factor. In present day practice, practically all of the lighting business is lead of high power factor, most of the heating load which is being taken on comes up to at least fair values, but much of the motor load presents opportunities for lower power factor. Inspection of the power factor curve of any induction motor shows the power factor falls off very rapidly as the load is decreased from around the full load point, and it is therefore apparent that a group of motors running at light loads present a problem calling for careful study. To offset this condition, preserving a good power factor, we may redetermine the motor sizes, make changes in the grouping of the motors, use synchronous motors for certain drives or install synchronous capacity for the power factor correction. It seems self-evident that the program for good power factor must provide for the education of the men who deal with the public.

We have not arrived at the point where something of substance is to be devised which will stiffen the general line of argument, when occasion demands, so that we may accomplish in actual practice the results which have been determined upon as essential. This simply means that we write into the service agreement our requirements as to power factor with a pro-

vision for the collection of a penalty from those who do not operate up the reasonable values taken as standard. To illustrate let me briefly outline the practice of the Company with which I am connected, as working experience shows that it possesses considerable merit.

1st. All schedules covering service in blocks of any size provide an arrangement for dealing with power factor.

2nd. Low tension—the low tension schedules make the following requirements.

5 to 50 kw.	demand	75%	lag
50 to 500 "	"	80%	"
Over 500 "	"	85%	"

3rd. 2200 volt schedule (generator voltage) (50 kw. and up)

50 to 500 kw. demand 80% lag
Over 500 kw. demand 85%

4th. Service at transmission line voltage

Neutral Power Factor 60% to 75% lag

5th. In the above arrangement the correction in billing is made by increasing or decreasing the monthly demand charge as the average power factor is above or below the allowable value.

The power factors given above are not to be used as a standard, as experience has proven that some readjustment is necessary, it is easily seen, however, that these clauses in the contract provide an arrangement by which the Company can protect its interest and thereby that of its Consumers. If the Consumer, at the time of purchasing his equipment, is inclined to neglect the matter of power factor the salesman can diplomatically point out the increase in rate which will result and then persuade the Consumer to provide apparatus which will give good operating power factor values.

It is frequently stated that discussion as to power factor is proper from the theoretical point of view but has no particular place in every-day practice; that much good time is devoted to argument but the net profits are small. Let us analyze the actual situation a bit by assuming a simple system layout which we can pick to pieces and see what part power factor

plays. We will also be able to formulate an idea as to the expense imposed by various power factor conditions. For our purpose we will assume that we have service to render to ten consumers with demands of 1000 kw. each, that the load factor of each is 100 percent and that current is to be delivered at low voltage; further assume that the ten consumers are to be fed from a central substation, this distribution being made at say 6,600 volts, the substation is supplied with power from a 66,000 volt transmission line twenty miles in length and that at the generating plant the voltage is stopped up from say 11,000 volts to that of the transmission line. The frequency chosen is sixty cycles.

To furnish the service required would call for minimum equipment expenditures with minimum loss then operated at unity power factor at lower power factors these items change. Let us obtain a few very rough figures for the principal sections of the system for lagging power factors of 90%, 80%, 70%, 60%.

Service Transformers 6,600—220 Volts.

To furnish the required 1000 kw. power the kva imput and output of teese transformers is increased as the power factor is decreased, the efficiency also is decreased with the result that extra kva capacity should be provided and loss is higher. Taking average performance data and pricing the energy and transformers at market prices, results are derived to give an approximation of the additional capital needed and the extra loss sustained for the various lagging power factors. In the following table the cost of annual loss is given calculated at 1½c per kwh, while the capital charges are figured at 10% on the extra expenditure.

TABLE No. 1.

Power Factor	Annual Charge for Losses	Annual Charge for Capital	Total
100%	$ 0	$ 0	$ 0
90	389	460	849
80	648	1048	1686
70	1037	1800	2837
60	1944	2864	4808

Distribution System.

By assuming the loads reasonably close to substation this item is neglected.

Step Down Transformers.

The extra charge due to the lower power factors have been calculated for the Step Down Transformers in exactly similar manner to that for service transformers except that the energy loss is figured at 1c per kw.h.

TABLE No. 2.

Power Factor	Annual Charge for Losses	Capital	Total
100%	$ 0	$ 0	$ 0
40	259	413	672
80	432	946	1368
70	697	1645	2342
60	1276	2640	3916

Transmission.

Should we attempt to maintain the regulation at the receiving end of the transmission line at a value of say 4% by increasing the copper size, we soon find, that, while on five foot spacing, No. 2 wire would suffice for unity power factor, the wire size for the lower power factors becomes prohibitive because of the higher rate of increase in inductive drop over resistance drop. To meet the problem we sacrifice something on regulation, thus keeping the wire size within reasonable limits. The wire size and regulation assumed together with the percentage loss are as follows:

Power Factor	Wire Size	Regulation %	Loss %
100	No. 2	4	3.8
90	1	5.0	4.0
80	0	5.5	4.2
70	00	5.75	4.4
60	000	6.5	4.5

With copper at 30c per pound the charges for losses and capital, as figured above, are roughly as follows:

TABLE No. 3

Power Factor	Annual Charge for Losses	Capital	Total
100	$ 0	$ 0	$ 0
90	2040	528	2568
80	4080	1188	5268
70	7320	2112	9432
60	7560	3168	10728

Step up Transformers 66000---11000 Volts.

The charges against the step-up transformers at the station are set up in a manner exactly similar to the service and step down transformer, an approximation is as follows:

TABLE No 4

Power Factor	Annual Charge for Losses	Capital	Total
100%	$ 0	$ 0	$ 0
90	282	532	814
80	473	1150	1623
70	763	1890	2653
60	1452	2790	4242

Generating Equipment

It is to be remembered that low power factor works for large and expensive generators; field windings must be increased, field losses are raised, exciter capacity must be enlarged and the miscellaneous generating apparatus including machine loads, busses and switching equipment brought up to the point where they will handle the larger currents. To complete the comparison which we are drawing, the following table will serve as a rough guide:

Power Factor	Annual Charge for Losses	Capital	Total
100%	$ 0	$ 0	$ 0
90	288	1520	1808
80	480	3280	3760
70	768	5400	6168
60	1476	7970	9446

Summary

In an actual case the various tables given above would not combine directly yet for our purpose we will put them together to form our conclusion since the error in so doing will not seriously affect our comparisons. United these five sets of charges are:

Power Factor	Annual Charge for Losses	Capital	Total
100%	$ 0	$ 0	$ 0
90	3258	3453	6711
80	6113	7612	13725
70	10585	12847	23432
60	13708	19320	33028

In this assumed system we would then say that some $33,000.00 per year is being expended for the use of money, losses, etc., to create and operate the layout with power factor at 60% over the costs for operation at unity power factor; expressed in another way the excess cost for 60% power factor operation required $193,000.00 more initial outlay, plus $13,700.00 per year for losses. Ideal systems with unity power factor perfect load factor and other 100% features do not exist in actual practice but is apparent that the system with high power factor is operated to far better advantage than a corresponding property with poor power factor.

The excess amount represented by a poor power factor condition, in an actual case, can well be considered as the capital stock of the high power program mentioned above, for we appreciate that a slight improvement in system power factor means real economy.

Our properties are going concerns and the engineers must take things as they find them, so we usually do not cut the system from whole cloth to the pattern of our own; we take as our problem the determination of a policy which will give best results today and prepare for further improvement in the future.

The problem of the commercial men to work out with his Consumer divides itself into three major parts:

1. With the new user to see that the selection of the initial equipment is such as to give a power factor up to standard and to so arrange that apparatus for future growth is satisfactory.

2. To work along with the existing consumer so that, as he adds to his load or makes rearrangements to his plant, the change in power factor is constantly for the better.

3. In particularly both cases detailed studies must be made and corrective measures worked out.

The physical and financial aspects of the question are more or less real and tangible but there is one other side which is easily overlooked; the moral effect of a well managed corporation is reflected in its employes and customers and a little thought will show that good power factor is closely analogous to good management. The Company man and the Consumer surely reflect through their daily work any such condition which is coming

to their attention in many small ways, and they in turn perform their duties with a corresponding increase in efficiency.

The future holds forth much promise for the Central Station; a new place era is ahead and in it will come much in the way of new loads and new classes of business for power companies. We will examine each new market as to its earning power, its stability, scope, etc., but we cannot afford to overlook the power factor for we must know its complete characteristics and make it fit into our already determined policy.

Good power factor is an asset for both company and consumer and if we recognize the situation, determine to face it, and study and work on the problem constantly, we shall produce results gratifying not only to ourselves, but to our stockholders and the public we serve.

In the consideration of load factors it is important to bear in mind that the term "load factor" simply expressed the relationship between the minimum power requirement and the average use of power during the interval in question, that is, we say that the daily load factor of a station is the ratio of the average load for the period of twenty-four hours to the peak load carried by the station during the same interval of time. As an example, we might assume a station with a peak load of 4000 kw. and an output of 48,000 kw.h. per day, the load factor of which would be stated at 80%.

From a simple analysis of the situation it is very apparent that load factor has a most important bearing on the cost of producing power, and it is vital that the relationship of load factor to the power cost be carefully considered when a new installation is proposed. Station load factor is a measure of the use which the consumers served are making of the generating facilities provided to furnish them with service. In similar fashion the lines, transformers, and other facilities are affected in the same way, and if we could assume the ideal case of 100% load factor, it would mean that all of the consumers were making the maximum possible use of the capacity alloted to them.

Many of the central stations throughout the industrial sections of the country have experienced within the last year or two a considerable increase in their load factors, due to the fact that consumers have been required, because of war production, to increase their output, and in many cases this has been accomplished by making further use of the equipment at hand; in certain cases plants always run on a single turn basis have during the war periods increased the working hour to cover two or possible three turns. Consequently, the consumers load factor has been raised from perhaps the

value of 30% to 60% or above. Just what dropping back in load factor we are to experience, where we have had this war-time increase is difficult to estimate, because the war industries have not sufficiently readjusted themselves to be able to tell the extent of the operation for the next few months to come. It is probable however, that working hours will be decreased, that the extreme pressure for production will be relieved and that load factors in many instances will fall off to a marked extent. Just how far the central station can go in keeping the load factors up during the next year is indeterminate, but the fact remains that a program calling for education of employees and consumers will produce very excellent results. Many of our consumers do not fully understand the benefits to be derived by operating their plants at the best possible load factor, although practically all of our power rates these days are worked out in such a way as to give the man with good load factor or the long hour user, as he is frequently spoken of, a materially lower rate. This point should be brought clearly to the attention of the consumer, and it is quite easy to so explain the situation that he will have a very clear conception of the desirability of working in the right direction, however, the custom of the business, working hours, materials, plant equipment and many other items, have considerable bearing on the question, and time and thought must be given to the subject by both the company and the consumer.

In looking over station production costs there is a very interesting relationship between the cost of power and load factor at various power factors, as the cost of producing the energe increases very markedly as these two factors decrease. A detailed study of this relationship is very enlightening to the commercial man, and it is suggested that wherever possible consideration be given to this.

We understand that the daily load curves of our generating plants show the period throughout the day-light hours with the load at various values depending upon the amount of industrial service rendered, and with the distinctive peak load at the evening hours with the usual drop after midnight, frequently termed the "valley" of the load curve. In such a load curve the peak may occur in the morning or the evening, but the valley is characterictic of stations throughout this vicinity. Many plans have been devised for the acquisition of special loads to fit into this particularly low spot, and many schemes have been worked out, more or less successfully, to induce consumers to make their requirements correspond as to time with this depression, and the offer of special low rates has been made to attract this

business. However, none of these have worked out as a commercial success except in rare cases, and practically all of us still have the valley in the load curve.

It would seem from a consideration of the loads at hand and the method in which they are operated that we must still contend further with this depression in the load curve, but endeavor to raise the base load so that the relationship between the average load throughout the normal day to the average load throughout the night period will be raised. In looking over the charts of several stations for a number of years back, it would seem that this growth of the night load has been coming along in a fairly satisfactory manner, due principally, I believe to the number of industries taken on by the central station who are making long hour use of their manufacturing equipment. This would suggest that there is a very good field of work for the central station man in picking out certain classes of long hour users and making an extra effort to connect these to his line, perhaps at his standard rates, if they take care of the situation or perhaps at modified rates, provided the standard rates do not make a proposition for long hour service which permits the customer to buy at a favorable price and the company to sell at a fair profit.

As just indicated, this matter of load factor is very closely related to the subject of rates. Since the rate must be ample to take care of the company's investment charges plus a return for the current consumed, the schedule under which the service is sold should make recognition of both of these items. As just mentioned above, most of the present day rate schedules do this to a more or less satisfactory extent, but if we are going to make a special effort to acquire the long hour business, the charges for the service must make the greatest possible inducement for the customer to buy, as his own cost of producing the same power will be correspondingly lowered as the load factor increases.

This subject is so large and connects in such a variety of ways with the different phases of central station activities that it is impossible in this brief space to even summarize the points of importance. However, it is suggested that the commercial men of the various stations inform themselves well as to the load factors of various plants and the resulting load factors of the system of circuits from which groups of plants are fed, and that the whole matter be considered at a future date in a round table discussion, so that each one of us may fully benefit by the broad experience of all.

RECENT DEVELOPMENTS IN INDUSTRIAL HEATING

By R. T. Kaighin
The Cleveland Electric Illuminating Company.

In this paper I am not going to attempt to take up the technical details of the various phases of industrial electric heating, but only touch upon the high spots and discuss the commercial possibilities and problems involved.

In the first place, you who are, or should be vitally interested in this subject of industrial heating, are the central station representatives. The present outlook for new business for the central station in the way of motor load is rather limited. The old isolated plants are either shut down and dismantled or their owners are just waiting for them to wear out, at which time they can change over to the central station service with a clear conscience. New factories are not going to consider an isolated plant in the face of the high cost of installation, labor and fuel. This will result in only a slow normal growth of central station business, due to the natural increase in the requirements of the community considered.

As a result the central stations must look to some other field for any phenomenal increase in business, and the field of industrial electrical heating stands out like an oasis in the desert (or a saloon in Detroit).

There are a few things that the central station representative must do at the outset before he can accomplish much in the way of getting the name on the dotted line. In the first place, he must make a careful study of the field for industrial heating. He must learn all the different applications possible for the use of this energy. He must get acquainted with the representatives of the manufacturers of different electrical apparatus involved. They will help him keep informed as to the latest developments in equipment. The General Electric Company, for example, is starting a course in industrial heating for central station representatives. The speaker expects to attend this course which will last about three weeks, at Schenectady, New York. The different commercial and engineering features will be studied under the guidance of the experts of the General Electric Company. Whenever the opportunity presents itself, the central station representative should visit the factories where this equipment is made and also visit plants that have already installed different applications for the use of electrical energy for heating.

About three years ago there were no electric japanning ovens in Cleveland. Mr. Carlson, of the Illuminating Company, went to

Schenectady and spent about ten days in the General Electric factories with their engineers. He absorbed so much information and so much of their enthusiasm that within eight months after his return there were about ten electric ovens in operation in Cleveland. The resulting load on the Illuminating Company's lines amounted to approximately 2,000 k.w.

A study should be made of the trade papers, as there seems to be an unusual amount of interest taken in industrial heating by the editor of these periodicals.

We will first consider a few points in connections with the brass furnace. The field for this furnace is the brass foundry, the manufacturer of plumbing goods, the manufacturer of any of the alloys of copper, for melting scrap copper or scrap brass. This furnace may also be used for oxidizing or reducing any of the above mentioned metals or their alloys.

There are three general types of brass furnace on the market; the induction type, where heat is generated by passing current through the metal to be melted; the arc type, where the heat is produced by an arc and reflected from the sides and top down onto the metal to be melted; the resistance type, where the heat is developed by the passage of current through a register and then this heat is reflected down by the sides and top of the furnace to the metal to be melted.

There are several manufacturers of brass furnaces. The induction type of furnace is made by the Ajax Mfg. Co. of Philadelphia, Pa. The arc type of furnace is made by the Detroit Electric Furnace Co., Detroit, Mich., and the Booth-Hall Co., Chicago, Ill. The resistance type of furnace is made by the Electric Furnace Co., Alliance, Ohio, and the General Electric Co., at Schenectady, N. Y.

The field of low temperature heating is the japanning of auto parts, enameling, drying paint, baking cores, break baking, etc. The electrically heated oven must compete against steam and both direct and indirect gas heated ovens.

There is only one generally accepted type of electrical heater and that is the resistance type. This consists of nichrome wire ribbon wound on porcelain to form the resister element. This heater is built by the Westinghouse Co. and the General Electric Co.

The ovens in which this work is done are of various types. There is the box type oven which consists of two sheets steel boxes, one inside the other and insulated from each other by about four inches of good heat

insulating material. There is the continuous type of oven, the semi-continuous type, and the drum type.

The following concerns manufacture ovens for the above mentioned work:

The Young Brothers Company, Detroit, Mich.

The Oven Equipment Company, Hartford, Conn.

The Industrial Heating Mfg. Co., Cleveland, Ohio.

Electrical heating in competing against low price natural gas must have some advantages or it would not be so generally adopted as it is. The main points in favor of electrical heating are: uniform temperatures easily controlled; superior product, due to the fact that there is no combustion in the heating of the oven and as a result the work does not get covered with particles of carbon as in the case of gas ovens when incomplete combustion takes place. The work in an electrically heated oven therefore would not have to be done over. There is less danger of explosion in an electrically heated oven, due to the fact that there is no open flame, or the parts of the oven do not become as highly heated. Steam ovens are limited to lower temperatures. unless high pressure superheated steam is used.

The higher cost of electrically heated japanning is offset by the superiority of product and the fact that the percentage of articles which have to be done over is practically nil.

Mr. Lohr, of the Chandler Motor Car Co., states that in comparative tests they found that with natural gas at 30 cents and current at 1 cent, it was an even break on cost when they considered the amount of work that had to be done over in the case of the gas oven. The doing over of this work cuts down their output considerably.

Electrically heated ovens may also be used to advantage to dry the paint on auto chasses and thus shorten the time considerably over air drying. The Cleveland Automobile Co. has just ordered a continuous oven of about 270 k. w. capacity, to be used for drying the paint on their chasses. They expect to materially increase their production by this method rather than use the air drying method for their chasses.

Another large field for the electric oven is in core baking ovens. Every foundry uses cores and the quickest and safest method of baking good cores seems to be with the electric oven. The great advantage of electrically baking cores is the ability to have uniform temperature throughout the baking compartment. This is almost impossible with other forms of heat.

Where the cores are not all baked uniformly, the result of the casting from such cores is unsatisfactory.

The subject of heat treating and melting of steel is a very large field and should be considered separately. The heat treating of steel is of great importance to the toolmaker, the automobile manufacturer, the manufacturer of high grade steel. The strength of steel and its ability to withstand sudden shock depends upon its grain structure, so that if steel of ordinary grain structure is properly heat treated, it will materially improve in quality. A good example of the benefits of heat treatment is shown in the case of the National Malleable Castings Co. They had a contract with the Navy Department to make anchor chain. They installed an electric furnace for melting their steel, and after casing links for the chain and properly heat treating the same in an electric furnace, their product under test was found to have a 25% greater tensile strength than the old forged chains, and the new method permitted a greatly increased output of more uniformly satisfactory product.

Another case where a heat treating firm in Cleveland lost a good account by not having an electric heat treating furnace. This furnace makes a business of heat treating steel for their customers. A firm in Erie, Pa., had a government contract for turnbuckles, etc., for airplanes. These parts had to be heat treated very carefully, and several times they sent a ton or more of their product, accompanied by a representative of their firm, from Erie, Pa., to Cleveland, to have this product heat treated and returned. After one lot had been spoiled by heat treating with an oil furnace, the Erie firm decided to buy an electric furnace and heat treat their own work. They soon installed a second furnace and they take care of their own heat treating work now. By keeping abreast of the times and nstalling new and improved equipment the Cleveland firm would have retained a valuable account in Erie, Pa.

A partial list of the manufacturers of heat treating furnaces is as follows:

The General Electric Co., Schenectady, N. Y.

The Hoskins Co., Detroit, Mich.

The Electric Furnace Co., Alliance, Ohio.

The Westinghouse E. & M. Co., Pittsburg, Pa.

The steel furnace is used to melt steel and alloys of steel. The advantages of the electric furnace are many, but four which stand out prominent show clearly the technical superiority of the electric furnace over other types. These are:

1. The temperature obtainable is limited only by the ability of the refractories to withstand it.

2. The furnace can be operated in any kind of atmosphere.

3. The heat generated is not due to the products of combustion.

4. Very accurate control of the temperature conditions in the furnace is possible.

In conclusion I wish to emphasize the fact that we found in Cleveland that by getting acquainted with the manufacturers of electrical heating equipment, learning the different applications and calling on these prospects and educating them up to the point where they are ready to receive a proposition from the manufacturers, we were more successful in getting a power load on our lines. We found that the manufacturers do not have time to educate the trade in general and it is up to the Central Station representatives to do the preliminary work in this connection.

We have arranged for some of the manufacturers of industrial heating equipment to be here today and to open the discussion. Others not on the program are here to aid in the discussion, and I hope you will all take advantage of their presence here today and quiz them on any phase of the heating problem that is not clear to you.

THE APPLICATION OF ELECTRIC WELDERS AND THE PROPER REMUNERATION FOR THEIR CURRENT CONSUMPTION.

Welding, one of the very ancient arts, is carried on through the agency of heat; forges and furnaces of various forms, are the common source of the heat required but we are beginning to appreciate the real advantages in many welding processes of supplying the required heat by means of the electric current. Electric welding has been practiced in a more or less limited way for years back but it is only within the last five years that it has taken a definite place in industrial operations.

To offset the great sacrifices of the world war, we logically expect some benefits, one of these which directly affects American industry is the breaking down of old standards by the introduction of new methods. The greatest pressure ever brought to bear upon our manufacturing plants has been exerted to increase production to the point of downing the Hun, this pres-

sure has led to short cuts and the trial and final adoption of processes which the more conservative would not have ventured with, except for the pressure and the wonderful incentive for larger output. One of the practical advancements is the quite general recognition of electric welding in some of its various forms.

The one outstanding feature of our participation in the war in terms of electric welding was the repair of the German Merchant Ships interned in our ports and badly damaged by their crews before being seized by our Government. The repair of the damaged parts in these ships probably did not actually develop anything new in the field of electric welding as the work done was simply the repetition of electric welding as carried out in the daily routine of some plants where the principles were well understood, but it did bring home to the country at large, the possibilities of electric welding, as the work was well done, for a most wonderful cause, and the fact that it had been done was broadly advertised. In other words, the light was taken out from under the bushel and the average onlooker begins to understand.

It is often argued, and correctly so, that in the great demand for war production, economy was sacrificed for speed; however, some of the advantages gained are real and among the outstanding features is the greatly increased field for electric welding. We enlarge our fund of knowledge by study and experimentation; so with the immense demands of the war period intensive study and broad experimentation were justified to the end that good methods were developed and poor ones rejected. A calm analysis of the situation relative to electric welding will disclose the fact that by far the greater part of the development brought about by the war is here to stay. The field of electric welding has been broadened materially by increasing the utility of the various processes and developing and improving the essential tools.

A brief survey of the general situation will make it clear that electric welding has taken a large place in modern industry so that it seems particularly fitting at this time to carefully consider just what this all means to the Central Station.

Broadly speaking, electric welding may be sub-divided into two general classes (1) Resistance Welding (2) Arc Welding. The most common form of Resistance Welding is known as "Spot Welding," a process by means of which two or more thicknesses of metal are joined, the joint or weld being produced by the passage of electric current through the pieces

from one electrode to another, the flow of the current raising the temperature of the metal to its welding point producing a solid mass of homogeneous metal between electrodes. In arc welding the required temperature if produced at the edges of the material to be joined by means of the electrtc arc, usually the metal to be welded is made one electrode and a stick of carbon or metal the other.

Closely related to the welding processes themselves are such uses as annealing, cutting, mild localized heat treatment, etc. These are almost analogous to the corresponding welding practice so that they will not be treated on in this article, however the Central Station salesman should thoroughly familiarize himself with the usual applications as they are now recognized as standard practice for certain operations.

The field for resistance welding in some of its various forms seems without limit, all of us can readily recall the first introduction of a spot welder on our lines just a few years ago while today it is usual to find this equipment in most all metal working plants. As mentioned before, spot welding is the common designation of one particular form of resistance welding being the welding application in most wide use and therefore the best known.

During the past twenty-five years the apparatus for spot welding of the ordinary sheets and light plates has been gradually improved until today the equipments on the market compare very favorably with all our industrial tools, as for instance, metal working machine tools. Such welding machines, as they are frequently termed, have been fully standardized, operating characteristics well determined and accurate data are available as to results and costs for various lines of products; this means that spot welding is now the established method for the performance of certain joining operations. In spot welding the current required to produce the welding temperature in the ounces to be welded runs to high values, 50,000 to 75,000 amperes not being considered unusual with the voltage usually say 5 to 15, this naturally puts spot welding into the alternating current load classification as the high current values and low voltage require a source of power as near the work as possible to avoid excessive cost and loss in the low voltage conductors. To meet this requirement the transformer to supply the large current at the low voltage is built in as an integral part of the machine.

To put before you points which are of interest in the every day operation of spot welding equipments, Mr. H. B. Craft of the General Fireproof-

ing Company, Youngstown, Ohio, has very kindly consented to give us the benefit of his experiences obtained from the operation of a large number of various size spot welders. Mr. Craft's notes are as follows:

"*Notes on Electric Spot Welding.*"

In recent years electric spot welding has been almost universally adopted for sheet metal and light plate work where riveting was formerly employed. While spot welding in itself does not necessarily mean a stronger joint than riveting yet the saving in time and labor affected by the use of the welding over riveting is enormous. Spot welding is used largely in the assembly of automobile parts including bodies and fenders, steel cases, steel furniture, safes, lockers, and all fabricated sheet products and light plate work.

One of the most difficult problems met with in the use of spot welders lies in the supplying of the necessary single phase alternating current. The average spot welder in use today has a rated capacity of perhaps 20 to 30 kilowatts or say 30 to 45 Kva. This means that a sudden momentary load of perhaps 200 Ampere is thrown on the supply circuit for each machine. The length of time involved in this load is extremely variable but in most cases it can be reckoned in seconds or fractions of a second. Due to the abruptness and short duration of this load it is difficult to maintain good regulations in the supply circuit. When current is supplied from Central Station this can only be accomplished by the installation of sufficient transformer capacity fed from lines of ample size.

When power is supplied from a generator the generating machine must be of sufficient size to handle the load and a large fly wheel effect is recommended.

Since the average power factor of a welder circuit is between 45 and 50% lag it is necessary to make provision for this large amount of wattless current in determining the capacity of transformers, lines and generators required. In an installation of one welder the transformer or generator capacity would theoretically be at least equal to the Kva. rating of the welder. For example, a 30 Kw. welder would require at least 45 Kva of power source and even then the overload capacity would probably be called into use on account of wattless current. In installations of several welders on a single circuit there is a considerable diversity factor between the total maximum load of the circuit and the total rated capacity of the welders in use, tests have indicated that this ratio is in the neighborhood of 60%.

To determine this diversity factor readings were taken on a welder cir

cuit on which four machines of various size were in operation. The total rated capacity of the four machines amounted to 544 amperes while the average of the high loads observed on the circuit was 330 amperes, giving a diversity factor of 60.7%. A second set of readings were taken on another circuit supplying three welders with a total rating of 469 amperes. With these machines in operation the average high loads observed on the circuit amounted to 288 amperes, giving a diversity factor of 61.4%.

These tests indicate that in an installation of a number of welders the capacity of the power source should be at least 60% of the total rated capacity of the welders. If sufficient capacity at the power source is not installed the drop in voltage during heavy loads will be excessive making it impossible to secure uniform welds. When the voltage is low a longer time is required to make the weld and when heavy stock is being used it is probably that no weld will be made at all. On the other hand if the voltage is high the steel will be burned, thus producing a defective weld. From this it is apparent that the regulation should be kept within conservative limits for good welding conditions. The voltage of the supply circuit should be regulated to within at least 10%, then it is possible to adjust the welding voltage at the machine by means of the several taps provided on the primary side of the welding transformer to make good welds, the setting of the taps being determined by the thickness and condition of the materials to be welded, also its shape.

The low power factor of the spot welder is caused by the inductive reactance set up in the low voltage conductors of the machine. As stated before the average power factor under normal operating conditions will run from 45 to 50% lag. However, with certain kinds of work such as welding small pieces the power factor will improve and perhaps average 60% lag. This inductive reactance is set up by the presence of iron within the field of the low voltage conductor. The introduction of sheets or large pieces of metal to be worked upon by the machine quite naturally increase the effect and this metal in the presence of the circuit carrying as high as 10,000 amperes produces a choking effect, thus accounting for the low power factor of the outfit. This condition is readily shown by welding on the side of a sheet of steel; the further the sheet is inserted into the throat of the welder the longer is the time required to make the weld since the choking effect in the conductors is constantly cutting down the power factor and the inductive drop is increased.

This condition is again demonstrated by taking power factor readings on the circuit while welding small pieces of steel and then again taking observations when welds are being made inside of a steel box or case with metal of the same character and size in which for example the low voltage conductor is nearly surrounded by the work. Readings have been taken with power factor value at 60% for making welds on small pieces, this would fall off to 50% where the welds were made inside of a box of the same materials. On this account it is necessary to adjust the welder voltage for a higher value when welding on the inside of large sheets or cases than that required for welding on small pieces.

In selecting the size of the welder, it is necessary to consider the shape and size of the work to be welded rather than the thickness of the stock, naturally this holds good only for stock up to certain thicknesses, say 3-16 of an inch.

It has been clearly demonstrated that the power factor of spot welders can be very considerably improved if both conductors of the welder are placed on the same size of the piece or pieces to be welded; that is, by keeping the iron or steel outside the magnetic loop we have cut down the inductive drop. In order to do this, it is necessary to make two welds at the same time and this method has been successfully employed in a more or less experimental way. However, to date spot welders of the character have not been offered on the market.

Successful spot welding in commercial practice is largely dependent upon the quality of steel to be welded. Rusty, scaly or dirty steel is difficult to weld on account of the tendency of the steel to burn at the surface before heating up uniformly to the welding temperature. When a well-finished, pickled and oiled steel is used good welding is very easy to achieve and the saving in labor and rejections results in increased production which will more than offset the increase in cost of good steel over the burned grades.

Spot welders are of two general types, hand or foot operated and power operated. Machines for the heavier classes of work belong to the former type while small machines designated for welding small pieces of light gage material are very frequently power driven to increase production. To date, however, the field of usefulness for the power welder is rather limited.

Since the process of welding is a combination of heating and pressure it is necessary to regulate not only the amount of heat by means of the voltage but also to vary the pressure for this class of work. The average welder operator makes the mistake of using too high a temperature and in-

sufficient pressure and while this method gives a quick weld and enables the operator to turn out a maximum amount of work, especially when working on piece work rate, it usually results in poor welds because of the burning of the steel. Whenever a welder is throwing sparks it is a clear indication that too much voltage and insufficient pressure are being used and that the welds are probably poor. This can always be corrected by decreasing the voltage and increasing the pressure. Most operators have the erroneous idea that in order to make good welds they must make the "fire fly," on the other hand the best welding is done when the steel is not quite up to the sparking temperature with the application of sufficient pressure to bring the parts to be welded into intimate contact. Also from the standpoint of power consumption it is desirable to use as low a voltage as possible and still make the weld in a reasonable length of time.

Mr. Craft concludes his notes with a general statement that the spot welder of today is a machine highly perfected and on which is just beginning to be appreciated by the manufacturers working on the class of material for which the machine is designated.

Spot welding has in the past been carried out on sheets and light plate but the place made for electric welding in the ship production program has brought about an ever increasing demand for spot welds on plate from $\frac{1}{4}$ in. to 1 in. in thickness.

To make such welds requires current valuesup to 100,000 amperes at around 20 volts and pressures up to 40 tons from which it is apparent that very special equipments are required. Mention of the current values and pressure bring to mind at once the difficulties to be overcome in cooling electrodes, proper application of pressure, reactive drop, life of electrodes, etc. All such obstacles have been mastered and it would seem perfectly safe to predict that spot welding of heavy plates and shapes is just ready for quite general adoption to replace many riveting operations. The ship building activity has been the immediate cause for this rapid development on heavy plate work but inland plate fabricators are now busily engaged in study and experimental work to determine the merits of this new method for their own particular lines of work. "Do it electrically" seems to be the slogan of today in all such plants.

The other form of resistance welding most frequently encountered is designated as "Butt Welding"; in this the pieces to be joined are pressed together end to end or edge to edge, pressure applied and current passed through the joint thus bringing the ends or edges to welding temperature.

The field for this class is perhaps not as broad as for the ordinary spot welding, but the development of the required apparatus has been a distinctive step in industry and one usually attended with large reductions in production costs. Here, too, the possibilities are increasing daily so that we must class this particular form with the others as further market for electrical energy.

The Central Station man is very naturally keenly interested as to the electrical characteristics of this form of load. As has been developed above the demand of the spot welder is comparatively high, of very short duration, while the power factor is low judged by the present day standards; the voltage of the primary winding on the welding machine thrasformers is usually confined to 220 or 440 volts while the energy consumption is small compared with the demand, which spell poor load factor. It would probably appear that such load is not desirable for the Central Station as it possesses most all of the points which go to make non-profitable business for our systems; it is one of the well proven principles of modern business that every factor must be judged not only upon its own merits but with proper consideration as to its relationship to all other factors. Granting that this forms a poor class of load an attempt will be made in a further section to formulate a method for proper earning to compensate. Before treating on rates and the commercial possibilities, let us look briefly into the field of Arc Welding.

The name used to designate this operation "Arc Welding" clearly indicates the source of the heat. This method has been in use for a number of years in more or less crude form and with varying results but the impetus given the subject by the war demands have made a phenomenal rate of development. The usual plan has been to strike an arc between the metal and a carbon electrode filling in additional metal in the form of a rod or "Melt bar". The early application of arc welding by carbon electrode was too rough work, as the process had not then been sufficiently developed to produce finished work. It soon was apparent that too long an arc would produce oxidization of the metal, while a very short arc would produce a very hard, brittle weld, due to high carbon. In this stage of the development much confusion was brought about as to the merits of various fluxes, proper polarity of electrodes, current densities and similar factors of more or less importance.

The next important step consisted in the quite general adoption of the metallic electrode to replace the carbon electrode, thus decreasing the drop

in potential and the arc length, this called for more skill in handling but produced better welds. Soft iron and mild steel usually form the electrodes which are used with and without flux; in certain instances the metallic electrode is coated with a solid fusing material. In many operations the matter of proper polarity is given careful consideration since the hottest part of the arc is at the positive electrode.

Just recently alternating current arc welding has been brought to the front and while the general results have been exceedingly satisfactory yet the field of application has been limited so that reliable data is just now beginning to appear. The field is very broad and with many investigators at work we may certainly look forward to a complete set of methods which may even surpass the present direct current process.

Mr. G. A. Hughes of the Truscon Steel Company, Youngstown, Ohio, has very kindly offered notes on Butt and Are Welding, which are here presented.

NOTES ON BUTT WELDING.

I am sending you the copy of original test on a 40 Kw. Butt Welder.

This machine is a 40 Kw., 220 Volt Standard Federal Welder & Machine Company butt welder.

We were testing it on a bar of iron with one square inch area and obtained the following results:

Tap	Volts	Amperes	K. W.	P. F.
8	220	200	40	91
	220	200	40	91
	220	210	39	84
	218	210	39.5	86
	220	210	39	84

This machine has eight taps on auto transformer to vary the voltage. The eight tap placed the welding transformer directly across the line. This last tap (8th) being used to make the weld. The time will vary depending on the unevenness of the ends of the stock to be butt welded. If corners stick out they must be burned off until all of the ends make contact, otherwise a perfect weld could not be made.

Unlike spot welding machines this butt welder has its secondaries so arranged that they do not parallel any iron and hence you will note a better power factor than in spot welding. Nothing is done to set inductor in the

circuit as in spot welding machines. The load is on longer and is steadier and a much better load than with spot welder. There is no use of entering into a detailed description of this as you are familiar with the operations of the spot welder and instead of passing a current through a piece of iron and getting a choking effect (depending on the size of the steel the spot is being made on) this condition cannot exist when two pieces of iron are butted together.

The law of resistance is followed exactly and a good P. F. is obtained.

After the pieces of material were squared, three minutes was required to weld it on this machine.

I am giving you the results of short circuited tests of the secondaries of this machine which shows the amount of current and Kw. and Pf. at different taps of the auto transformer located in primary circuit of welding transformer. This shows an ideal condition existing. Resistance in primary being used to hold secondary current down to a valve that is now dangerous and makes it a Fool Proof Machine.

SECONDARY---SHORT CIRCUITED

Tap	Amperes	Volts	Kw.	Pf.
1	47.5	219	9.	86
2	66.	225	12.5	84
3	91.	223	16.5	81
4	120.	220	22.5	84
5	157.	222	27.5	79
6	175.	220	28.5	74
7	220.	220	37.	77
8	285.	216	44.5	72

This shows much better than the spot Welder, as you will notice.

A short trip through any industrial district devoted to metal products will thoroughly convince that electric welding is playing a very important part in these various lines of work and this despite the fact that great strides have been made in the application of gas welding. Such a casual inspection will be of profit to the Central Station man who is not conversant with the tools, methods and their great usefulness. This is one of the newer industrial means, constantly being improved.

The modern Central Station has a very definite function to perform in the territory within which it operates, viz., to serve with its product all those who have need for such commodity. It is granted by leading operators that the future prosperity of our companies lies in carrying out this

ideal by increasing the use and density of business within a given area. In practically all communities one of the larger, if not the largest field of load, is industrial business, lighting, motor service and electrical heating including welding. It follows, then, that if our plants are to progress toward their ultimate goal the loads that are available are to be taken care of, naturally including the industrial load a part of which is the welding. As outlined above, some of this welding business is not particularly attractive in itself and we would not care to load up our plants with it but it is a minor part of the industrial load perhaps the most desirable now in the field so it is very good policy to include the whole load thus doing the thing which we are in existence for.

It often happens that service for welding installations offers the entering wedge into a plant which it has been impossible to place on the line; given this start the alert commercial man will enlarge the opportunity as occasion permits until with good service and fair treatment the entire plant is being supplied.

Take the case of a manufacturer operating a direct current plant for motors and light; he sees that the installation of a spot welder will eliminate a riveting operation with an apparent decrease in cost and improved product, this machine requires alternating current of which he has none, naturally, he turns to the power company. The company might be loath to take the business on because of its low load factor, poor power factor and low earning power, yet it is wise to accept the load since the welder, if wisely chosen for the work, will give exceedingly satisfactory results and actually form a bond between this prospect and the Company. Other welders may follow, perhaps night lighting may soon be supplied, then a power for a few motors and soon the whole plant is on the line; a very stable, lasting and valuable addition.

If we are agreed that electric welding is one type or class of industrial load to be reckoned with it is then proper to look to our revenues from this class of business. Direct current arc welding where the welding current is supplied through the usual motor generator sets does not offer the disadvantages of the other classes although the load factor and power factor are lower than we would like: the load, however, is sustained for an appreciable length of time, all conditions being quite stable during the load interval or in other words, until the arc breaks. Alternating current arc welding in its common application will probably have about the same general characteristics as the direct current except that the power factor and

the load factor be slightly lower; as more data are available this load can be more closely analyzed. In brief, it would seem that our present practices are to demand and energy measurements carefully applied and translated into dollars through existing rate schedule which take account of power factor conditions, will yield a very reasonable return on our investment and energy costs. Study should be given this situation as our experience grows; particularly with reference to the alternating current arc welding.

The resistance welding, including both spot and butt welding, appear to require special attention to determine whether or not our return calculated in the ordinary fashion is commensurate with the service rendered and does not discriminate in favor of the small spot welding installation.

The normal rating of the usual spot welding equipment ranges from 5 to 75 kilowatts per welder with ratings of about 30 kilowatts predominating. The usual operation of such a welder calls for the very frequent instantaneous closing and opening of the circuit and from a large number of observations it has been noted that the load interval ranges close to one-half seconds for a typical welding operation. Occasionally a welder is observed on work requiring a load time of as high as three seconds but such cases are exceptional and nearly every installation is included in the former class. The cycle of welding operation varies greatly according to the work being handled and ranges from as low as 30 welds per hour to as high as 1,000 welds per hour while the average installation probably makes 400 welds per hour or about 7 per minute throughout the working day, this being based on the assumption that there is sufficient work at hand to keep the welder busy.

Thus our metering equipment is called upon to measure a load of 30 to 40 Kva. for one-half second or less possibly seven or eight times per minute for the average installation. Theoretically, our present day meters should measure such a load in satisfactory manner but from experience it would seem that this does not actually work out in practice. A casual observation of the theoretical performance of integrating watthour meter reveals the fact that its ability to measure such a load is based on the assumption that even though the meter disc lags behind the load to a certain extent during the acceleration period, yet this lag in acceleration is counterbalanced by the same lag in deceleration with the result that the meter should record the actual load over the given time. It seems to work out, however, that the load interval is so short and the peak so abrupt that it virtually amounts to a short circuited condition for the period of load on the

welder. Perhaps our metermen will question this statement, yet from close observation covering several years and by independent observations, it is reasonably safe to say that the energy registered on a small installation of such welders probably does not amount to more than 25 to 35% of the current used.

For a group of welders it would seem that the load curve should straighten out materially and that the energy consumption as registered should correspond very closely to the actual use. In one specific instance on which observations have been made, consisting of ten welders with the welders in regular operation. Tests taken on a single phase meter on the welder circuit indicated an average requirement of but 12.5 kilowatts during a ten minute test compared with a total rating of 250 kilowatts for the welders. These welders were making around 15 welds per minute on each machine and even though the operation of the welders would have been such that the load was constant and calculating only one-half second per weld the meter should have indicated an average requirement of not less than 45 kilowatts or almost four times that actually shown. As a check against the above data a test is cited where a group of welders rated at 400 kilowatts was operated from a single phase generator of 150 Kva. rating and with these welders in regular operation the generator lacked sufficient capacity to hold up the voltage making it necessary to reduce the number of welders. From general observation it would seem that the rating of a generator to supply spot welder should be approximately one-half of the capacity to be supplied.

We see from this that in the small installation the energy is registered is probably less than that actually used while our usual methods of demand measurement also fall short. It would, therefore, seem logical that some special means should be provided to determine that the company's revenue does correspond with the service rendered. It has also been brought out that the single phase generator capacity required for a group of welders must be equal to at least one-half of the total welder capacity and in case a consumer were putting in a generating equipment of his own to supply this service for a group of say five to ten welders, it would be necessary for him to provide generator capacity in which the Kva. rating would be approximately one-half of the welder rating in kilowatts.

The problem presented in providing a proper and sufficient metering arrangement is one requiring detailed study and is beyond the scope of this article so that a means should be provided for producing the required revenue

by the use of the metering equipment now at hand. In an installation where the welding load forms a considerable proportion of the total or where we have an installation of welders only the above observations hold true but where the proportion of welder load to the total load becomes small, it is readily seem that the power required for welders, the peaks and low power factor are absorbed in the total so that the deficiencies in measurement do not apply in as acute fashion with this combination as in the former. One other point is perhaps necessary in order to make the situation clear since it has been suggested by some Central Station operators that the transformer capacity is the proper measure of the maximum demand, it is only necessary to reflect for a moment in order to understand that the modern transformer has a very considerable overload capacity and if the overload is not sustained for a sufficient length of time to develop excessive heat, the transformer will handle high peaks without injury. Applying this to our spot welding practice we made use of the overload capacity by having a group of service transformers handle peaks ranging to 200 or 250% of their rating. It is in the distribution lines, however, that the effect of the welders is measured for the short acute peaks pull down the voltage and if these same distribution lines are used for lighting purposes the regulation is extremely poor unless the lines are of ample size to accomodate the total load including the high peaks of the welders. Therefore, the measure of our capacity allotted to the welding load is the line proper rather than the measured demand or the transformer capacity.

We have said above that the single phase generator capacity required to serve a group of welders would probably equal one-half of the total welder rating. On this assumption it would be proper to bill the maximum demand at one-half of the connected welder load. This, however, might seem a little severe on the consumer and, bearing in mind that he has welders out of service very frequently, it is suggested that in the case of a single welder the maximum demand be taken at the full rated capacity of the welder, that in the case of perhaps two or three welders the demand be taken at say 60% of the total rated welder capacity and that in installations running from four to seven welders a factor of 50% be employed and that for larger installations the factor be $33\frac{1}{3}\%$. These values are rather favorable to the consumer since it is well established that his own capacity to save time if furnished from a private plant would be considerrbly higher. For the installations where the welder load is but a small part of the total load, it would seem advisable to have demand tests taken frequently if demand meters are

not used since the welder load may have an appreciable bearing on the total demand. In these installations, however, it is probable that the effect will not be greatly noticeable and, furthermore, in many of such installations the consumer provides his own transformer equipment and is responsible for the regulations of lighting service used from his main transformers so that the problem is about equally divided between company and consumer.

The conclusions which we can draw are:

1. Resistance welding is well tried and proven, especially spot welding, its appliances are well developed and it has established for itself a definite place in industry

2. Direct current arc welding is fast approaching the status of resistance welding.

3. Alternating current arc welding has been found extremely satisfactory for certain purposes and its use will undoubtedly grow, perhaps to the point where it will take rank over the other forms.

4. That the Central Station must, for its own good, be definitely linked up with this modern industrial tool. Remember we have said "*Do it Electrically.*"

5. That in justice to our shareholders and the public we serve we must do our full share even to the point of having the revenue in proper ratio to the service rendered.

In conclusion the Industrial Power and Heating Section of the New Business Co-operations Committee are thankful to all who have so generously assisted in the success of our meetings, including the members of the Commercial Lighting and Merchandising Section of the Committee and our esteemed Secretary, Mr. D. L. Gaskill, for his cheerful and prompt assistance and suggestions when needed.

W. B. Wilkinson, Chairman.
J. C. Matthew.
M. W. Arthur.
L. W. Hench.
A. C. Shepherd.

Mr. J. C. Matthieu, Dayton: With reference ti this last recommendation, we have found that some very valuable points were brought out in the discussion that were not reported because there was no stenographic reporter present; and therefore we recommend the employment of one.

President Oppenheimer: Gentlemen, you have heard the very interesting report of this Committee, which we are now ready to take up and discuss. I trust that the discussion will be fully participated in by many of the members present, as there is no doubt it will provide many interesting and beneficial facts to all. We would like to have the discussion opened by Professor Caldwell, who took a very active part in the preparation of a portion of this Report.

Discussion

OPENED BY PROF. F. C. CALDWELL, O. S. U., COLUMBUS, OHIO.

Mr. President and Gentlemen, I would like to call attention first to the fact that the paper on the Code which has been given this morning was presented on March 19 at Toledo, and has not been modified since then. In that period some changes have been made to which I would like to call your attention; but I want to emphasize the fact that this does not represent absolutely the state of the case at the present date, but as was presented on March 19. You will notice that when this paper was presented at Toledo each member of the audience had in his hands a copy of the preliminary form of the Code. I am sorry that that is not the case to-day, and presume that possibly we might have arranged for it if we had had it in mind.

I should like to impress upon the members of the Association the importance of the safety Codes of the Industrial Commissions and especially of this particular safety Code, the Factory Lighting Code. I do not believe that the members of the Association have come to appreciate the importance of these Codes up to the present time; in fact, I think that a great many did not even know of their existence. But this work is being carried out. Unfamiliarity with it on the part of the membership is probably partly due to an oversight on the part of the Industrial Commission people, if it can be called such, in that they did not include the Central Station people as part of the industries of the State. They have had a list of the manufacturers, to whom they have sent notices

of the hearings on these Codes as they have been held in the different parts of the State. I am under the impression that the Central Stations have not been included in that list and consequently the matter has not been brought to the attention of the Central Stations in the way that it probably should have been. In some of the later hearings on this Lighting Code, I realized the situation and made every effort to get word to the Central Stations in that part of the State where the hearings were held. Of course several of the Codes in addition to the Lighting Code will probably apply in one way or another to the Central Station industry which as an industry is an employer of labor and as such interested in all provisions that are being made for the safety of labor; of course not to the same degree perhaps as the manufacturers, but they still ought to have the matter in mind. I should think that it would be well for those individual members of the Association to whom this matter appeals as one of importance to write to the Industrial Commission and ask to be placed on their mailing list for information in regard to future hearings; or possibly it might be well for the Association to pass a resolution asking the Industrial Commission to place the members of the Association on the list as a body. Now that applies to the Code generally, but of course such a Code as the Foundry Code would not be of such great interest. The Code on Sanitary Heating and Ventilating would affect the Central Station industry to some extent; but above all, this Factory Lighting Code is one of the greatest importance to the Central Station people, not primarily from the point of view of its effect upon them as requiring them to put in more light, although doubtless the application of the Factory Lighting Code may mean that Central Stations will have to put in more light in some of their buildings. It will affect the Central Stations in that way; but of course that would be a small item when compared with the importance of that Code as a means of developing business for the Central Stations. It is going to require the putting in of more light by a great many industries, and that light is going to be electric light, and the members of the Association are going to supply that light; so you see where we get in on this. I feel that the Central Stations have not known as much about this as they should and have not taken the interest in it that they should as a factor in the production of business.

Now with regard to the present status of the Code, since this paper was written further hearings have been held, and on the final meeting of

the Sub-Committee your Committee was kindly given a hearing and the Code has reached its final form as far as that Committee is concerned but has now to go to the Advisory Committee of the Industrial Commission, which as mentioned in the paper is made up of representatives of manfacturing and labor organizations. After it comes up to the Industrial Commission for final recommendation it will still be in some danger, in this way: There are certain special industries, notably the steel industry of the State which for certain special reasons are opposed to the Code in its present form because they believe it will be a burden on them. It is probable that they will have representatives at the meeting of the Advisory Committee when this Code comes up for consideration. It is probable that they will even go to the Commission itself if the Advisory Committee recommends the Code to the Commission in an effort to prevent this Code from being adopted by the Committee. So that it is in order for all friends of the Code, all those who believe that the Code will be a good thing in any way at all, to stand back of it. I might say that the reason why the steel industries are opposed to the Code are, in the first place they believe that too much light is being asked for in some of their big mills. The steel industries have been accustomed to making steel by the light that comes from the hot metal for so many generations that they have come to feel that is all the light anybody ought to have; so when you ask them to put even a minimum amount of light in their mills they feel that an unjust burden is being placed upon them. But I think that a large factor in their opposition is their feeling that it will make another opening for the ambulance-chasing lawyer, and that is where their principal objection to it comes in. That is the stand they take.

That is the present situation of the Code, it is in the hands of the Advisory Committee and it is due to be considered by them at a meeting to be held not very far in the future, and then if they see fit to be recommended to the Commission for adoption in such a way as the Commission shall see fit. It is pretty evident that the Commission will not adopt it as a General Order. When the Commission adopts it as a General Order it becomes part of the laws of the State and is subject to enforcement and penalty if not carried out. The Commission, however, will probably not adopt this Code as a General Order immediately. It has been recommended to the Commission by the Committee and by the Director

of Safety that in view of the new ideas that this Code presents to the industries, and also in view of the fact that it is not in some respects very well established, that it should be used as a basis of inspecton by the factory inspectors for a period of one year at least, and perhaps two, before it is adopted as a General Order and thus becomes part of the State Law. That will give the industries time to adapt their lighting systems to the requirements of this Code.

A word with regard to public hearings. As stated in this paper, the method of construction of this Code after it had been drawn up by the Sub-Committee, has been to have these hearings around in the different parts of the State. There have been at different times two in Columbus, two in Cincinnati, two in Cleveland, one in Toledo, and one in Youngstown. I am a great admirer of this way of making laws. If more of the laws of the State could be made in the way that these Safety Codes are made we would have less and much better laws than we do have. Although the Committee did the best they knew how in the drawing up of this Code, and thought they had a pretty good Code when they started, having formed it on the model supplied by the I. E. S., but at almost every hearing that we have had points have been brought up which when considered by the Committee were recognized as being improvements in the Code. While the Code is still easily recognizable as the same Code that they started with it has been modified in many respects since it was first drawn up by the Committee. When the Sub-Committee got through with that Code it had received a whole lot more consideration than most of the laws that go to the Legislature for action by them. The public hearings have overhauled it in such a way that it certainly is a lot better than it was when the Committee first thought they had it in good shape. So I believe that public hearings as a means of constructing these Codes are a fine thing.

At the first hearings that we held we found a very decided feeling of opposition in the audiences. Everybody had an idea that something was going to be put over on them, and that too high intensities were being called for. I think some people had an idea that this was something that the electric light people were going to put over on them in order to sell current. We recognized that feeling very plainly, but it has been gradually eliminated. Some of the people who opposed the Code at the start, when they came to measure up their illuminants were

surprised to find that they had more illumination than called for in the Code. That helped a lot. Then some men got up at later hearings and told what intensities they had in their factories greater than even required by the Code, and the result was that the later hearings were distinctly constructive because the attitude of most of the audience was friendly and constructive.

One reason why I would particularly like to have you have copies of this Code is in order that you might know the classification of the intensities that have been provided for industrial operations. Our Committee was the first one that undertook to give any definite specifications with regard to what units should be provided for different kinds of industrial work. We hesitated somewhat before we undertook it, because we realized it was not a thing that had been well established at all, very little had been published about it. Some men have devoted a great deal of their time to industrial lighting, but no very definite ideas have been arrived at as to what units should be used except in certain particular lines of work. In some lines, such as the textile industries and machine work some of this work had been done and pretty definite ideas arrived at. But we undertook to make specificatons which would cover all the important industries of the State. The result you see in this pile of typewritten matter of six or seven pages. Each of these different industries is sub-divided into different classifications. For instance, here is chemical work, beginning with furnaces, hand furnaces, tanks for cooking, etc., and going down through all the different processes that you will find in that industry. That table we feel is exceedingly important in the study of industrial lighting. As stated in the article, we do not regard it as perfect by any means, so much so that we are not willing to include it in the Code but simply put it in an Appendix as a basis for future work. It is very important that every one who has to do with this order should make every effort to improve that list wherever it may be improved or wherever it is found to be inaccurate, wherever the intensities called for here are lower, or higher, than they should be, to assist in getting that straightened out.

Another point that I want to emphasize is the fact that the intensities that are called for here are safety intensities, intensities which are considered necessary from the point of view of the health of the workmen. They are far below what are coming to be known as production intensi-

ties. We have a second column of figures here headed as Preferable Intensities. We feel that if we simply were to give minimum intensities it would give a misleading idea to manufacturers as to what were proper intensities; that seeing these intensities stated here they would think they were the intensities they should use. We want to emphasize the fact that they were way below the intensities they should use, they are minimum intensities. Consequently we put in the the second column, so that where the minimum intensity is 3 the preferable intensity is indicated as being from 4 to 12 foot candles. Now the final edition of this Code as adopted by the Commission will probably be available within a few months, unless its opponents should succeed in so expurgating it as to make it inoperative and destroy all the work that has been done up to the present time—which I do not believe will happen, but is a possibility I was going to suggest that if any of you would like to get copies of this Code in its final form as published by the Commission and will care to put your name and the words "Lighting Code" on a slip of paper and lay it on the desk or hand it to me, I will be glad to see that you are supplied with the Code. Of course if general action should be taken putting the whole Association on the mailing list of the Commission that would not be so important.

If there are any questions in regard to the Code I would be very glad indeed to answer them.

President Oppenheimer: Gentlemen, this is a very important subject, one that would take some time probably to thoroughly digest. Our time is limited, we were a little late in getting started, yet we are ready to hear from any one else who would like to make any remarks upon this report. If there is any one present who would like to discuss it further, or ask any questions pertaining to it, we would like to hear from them before proceeding to something else.

Secretary Gaskill: I think probably some statements from your Secretary is due in view of the recommendation of one of the Sections. In the first place, referring to the Commercial Lighting and Merchandising Section of the Committee, they have done splendid work. They have had a hard row to hoe in the last year on account of the influenza and other factors that entered into their work. But that work is

very important to Central Station men. The Central Stations have not found any trouble selling their low-priced current in the last two or three years. The thing that has concerned us most is the selling of the high-priced current, and that is the factor that the Lighting and Merchandising Section has laid particular stress on and it is one to which all of us as operators ought to give very careful attention.

Now the Committee recommended that a shorthand reporter be employed to report these Committee meetings. About two years ago the Executive Committee took positive action upon that and decided that it was inadvisable, from two standpoints: in the first place, it is bad from a financial standpoint because what would be taken down at these meetings would amount to more than is covered in a full day's session of this convention, and probably the cost would run anywhere from $100.00 to $150.00 for each meeting of the Committee; and the Executive Committee felt that expense could not be met by the Association. Next, we found that if you put into these meetings a Shorthand Reporter every man that you wanted to hear from would shut right up and not say a thing; so we found it better to so arrange the meetings that everything that was said would be carried away in their minds and not on paper. So that is the reason why you have not been provided with a Shorthand Reporter in the past. I doubt seriously whether the finances of the Association or the result that you would obtain would be quite what you might expect they would be.

Another thing, it strikes me that a word ought to be said about the conditions we have passed through in the last two years when the Government was asking us during the war to curtail in every way possible. I remember very well a statement made by Mr. Lindsay in one of the Executive Committee meetings, that what we needed was to make people use light and power more economically. I feel that that was true in every sense of the word and that it holds good after the war just the same. You never want to over-sell a customer. What you want to do is to give him what he wants with the very least amount of expenditure upon his part, and then when you come to sum up the results at the end of the year you will have more money because of your good service than if you go out and try to get people to use your current in an uneconomical manner. I regret very much that we could not publish the Report of the Industrial Power and Heating Section in Advanced

Copy, because it came to me too late; but the papers that are in that Report all but one have already been published in the Monthly.

I would like to ask all Chairmen of Standing Committees that they see that the papers that are presented at their meetings are sent to the Association office. A good many of the very best papers I never receive. Whenever they are received, sooner or later they will appear in records of the Association and you will then have them if you want to use them; but where I do not receive them of course they cannot be published in the Monthly. I would urge that during the coming year the Committee see that all papers presented are sent to the Secretary so that they can be published at the earliest possible moment.

President Oppenheimer: Has any one else anything to say on this subject, or any remarks to make?

Mr. W. L. Wallau, Cleveland: In line with the Secretary's remarks, I would suggest that the executive committee instruct the chairman of the various Committees to send the papers to the Secretary as he has suggested.

President Oppenheimer: Gentlemen, we have with us a man who while he is not connected with the industry yet because of his official position in the State of Ohio he comes in close contact with a great many of us. He did not come here for the purpose of addressing you, but we want to call upon him so that you may meet him, see him, and become acquainted with him—Mr. L. G. White, Engineer of the Public Utilites Commission of Ohio. I would like those of you who do not know him to have the privilege of doing so. (Applause).

REMARKS BY MR. L. G. WHITE, COLUMBUS, OHIO.

Engineer Public Utilities Commission of Ohio.

Mr. President and Gentlemen, I want to thank you. I am not a public speaker and have not been assigned any subject to talk on, but I might say a word or two relative to some of the experiences we are having in our work in connection with the Commission. Many of your proposed rate schedules find their way to my desk before they come to be filed, and from my experience in going over them I am of

the opinion that a good many of the companies need some advice in the matter of preparation of schedules. It occurred to me just a few moments ago that it might be well for this Association to have a Committee make a study of schedule making, which of course would include as its foundation a cost accounting system.

Many companies have made expenditures which they could not capitalize because they did not keep their accounts and vouchers. The establishment of accounting systems have changed that and there is little if any trouble of that kind now. But with regard to the question of schedules there is no uniformity of practice in their preparation. About two weeks ago one of them came into my office, and going over the schedule I found that it actually defeated its own purpose, and I sent it back to the company advising them that they submit a new schedule.

In another case a party came in and I happened to know that he purchased his current from a large producing company. He had made a schedule such that his demand charge started out with a very high rate for the first ten Kw. and then dropped down very close to his current rate, as a result of which he would certainly lose money. I called his attention to it and he will probably modify his schedule.

It seems to me that this Association might benefit the smaller companies particularly that have not had experience with schedule making. If a Committee were appointed to make a study of schedule making and its underlying principles applicable to all schedules, and which should be made public in order that there might be greater uniformity as well as some rational basis of treatment.

I think that is about all I have to say, gentlemen. (Applause).

President Oppenheimer: Gentlemen, I am glad that I called upon Mr. White because I think that he has opened up something to which we should give very serious thought, and that is the matter of schedule making both from the standpoint of the Central Station and that of the customer. As Mr. Gaskill a few moments ago wisely stated, we should follow a system of economics in the use of light; and the matter of schedules and rate making is very essential. I am reminded of a very successful salesman whom I knew at one time, who seemed to sell goods without any particular effort. I always noticed that he never

urged any one to buy his wares, and I asked him why he was so successful although he did not urge people to buy. He said that if it was left to people's choice they would buy what they needed, but if he urged his stock upon his customer and overstocked him and the customer could not dispose of the merchandise he would blame the merchandise and not himself; but if the customer bought what he needed he would be able to sell the goods and he would praise their good quality. The same thing holds true of electrical current and is something that I think we should follow up very closely.

In opening our session this morning the first assignment on the program was an address by Mr. William McClellan, Vice-President of the Cleveland Illuminating Company. He was not in at the time, but I understand he is in the audience now, and it is with pleasure that I ask him to step to the front and deliver his address. (Applause).

ADDRESS BY WM. McCLELLAN, VICE PRESIDENT,

Cleveland Illuminating Company, Cleveland, Ohio.

(After apologizing for the fact that he had not been present to deliver his andress earlier in the session through a misunderstanding as to the program, the speaker continued as below—).

Mr. President and Gentlemen, I have just come into the State of Ohio and appear before you as an operating man. I am glad indeed to be here and address you as fellow workers. Some of you may not know that I have been in the State a great deal doing special work in connection with some of the companies, particularly the Cleveland company. Upon the invitation of Mr. Lindsay, I joined him in some work in Cleveland which has impressed upon me very forcibly the burdens that you men have been and are carrying—burdens that cannot be dropped at will, problems that cannot be solved immediately but that take a great deal of time, a great deal of energy at times in order to solve them. That you are imbued with a sincere honesty of purpose in your endeavor to solve these problems I am quite certain, and I am very glad to join with you in taking up these problems of operating again.

When I was asked to make this address of course I had to think of what I should say. It occurred to me at first that I might talk about

a great many technical problems in which you are interested and with which you are more or less familiar, and perhaps as to which I could not say anything new although I might perhaps dress them up in a little different form. But while such topics are all interesting, for example, the subject of rates which is always with us and very important, it occurred to me that that problem is intensely local in its nature. I believe thoroughly that the proper treatment of the matter of rates is in the direction of simplification, to have rates that are easily understood; but a man cannot go very far in a general address in an elucidation of the rate question.

Then there is that other great subject that is with us constantly, sometimes I think getting closer and closer as a vital problem, and that is our relations with the community, financing, and problems of that sort.

Nevertheless all of these are to some extent local. I think there are certain general ideas that are becoming more and more practical, more and more susceptible of proper working out; for example, in financing I believe that it is extremely important that so far as possible we get more of our customers, more people in our community, directly interested in the ownership of our companies as its support in times of stress and danger. I think that after all, the people themselves have proven that they have a desire in a sense to share in the ownership of the companies. I think that perhaps it is that very feeling that somehow or other the companies should properly belong to the community that has led some to make a political issue of it, and so I think it is extremely important that we give more and more study to matters of that sort.

But I think it ought to be of more interest to you if I stopped for a few minutes to speak of certain larger problems, certain ideas that perhaps are not so local but which are at the same time very vital and have direct relation to all the local problems which we have to solve.

Now I would not have you think in discussing some of these problems which have been emphasized during the late war just finished that they originated solely because of that war. That is not so. They have been emphasized, they have been brought more closely to our attention, some of them have been so to speak pushed ahead a little faster because of what we have been going through than

would have been the case in the ordinary course of events; but nevertheless, so far as our own local world is concerned in the United States of America we are working under new conditions. I am impressed more and more as I hear some men talk of the utter uselessness of the data and experience which they have accumulated through years of efforts and the uselessness of which they admit freely so far as solving certain problems that are presented now. Old conclusions, old formulas, old data, do not seem to work now; and in looking around for an explanation of this I think I see some of the reasons.

Now there are men who will say to you, "This is the same old world, it is the same old human nature, we do not need to think about many of these things, we can just go along our way in the same old fashion and according to the same old plans we used to have." I think such men are making a mistake; I am perfectly willing to admit that fundamentally human nature is a very steady going sort of thing; but unfortunately human nature works itself out through environment, through men and women, and we cannot always recognize it just as we cannot always recognize on short notice a man whom we have previously known. He may have put on another suit of clothes, he may have shaved off his mustache, he may have had a hair-cut, he may have done any one of a number of things to so change his appearance that for the time being you may not recognize him. In the same way, his moral purpose and his whole plan of procedure may be changed by certain changes of environment. So we cannot simply say, "this is the same old world." It is true, I am prefectly willing to grant that if you will go back far enough in history and carefully study the series of world events you will find that there are certain fundamental facts of human nature and that there is a certain world progress in a very orderly fashion. In the same way you can take a load curve and plot it out and find that it shows certain general characteristics in the course of the year, also daily, weekly and hourly as to which you can draw a certain kind of an average. Sometimes that average is a very important thing to ascertain, sometimes you are very much interested in the successive humps and hollows as they occur. That is exactly the condition we are in with regard to solving our great problems in public utilities just now. Let us go back to 1865, for example, to illustrate the point I want to make, at the close of the great

Civil War which rocked this country to its foundations. Many men to-day are reasoning about conditions now and drawing deductions comparable to the conditions which prevailed at the close of that war, as to the way men acted, the way business was conducted, and the changes in its methods, and which they seek to apply now to our present conditions. I have read various papers in which men tried to carry out that idea, and in which I think they forgot one thing. If you will glance back at that period you will remember that there were not then so many different states and territories as there are now and that there were more public lands. You remember how a man could go out into the far West and work out opportunities for himself, partly through the help of the Government, and partly through his own efforts. You remember what the emigration was in those days. You remember that we were getting a large influx of emigrants of Anglo-Saxon extraction, English speaking peoples, who came here and easily assimilated our institutions and our ways, and who put upon us a very little burden in their assimilation, because they understood our particular brand of civilization. In those days an individual having pluck and initiative could go out into this country and make his way and accumulate wealth and capital; it was only the man who did not want to work that was actually held down in some narrow groove.

Now some fifty years later we come to the close of the great World War and we find a totally different state of facts; we find this whole country organized into states and territories and we do not have the great public domain ready for distribution that we formerly had. We find that our industrial organization is much more complex, and it is much more difficult for the individual, no matter how much initiative, originality, or brains he may have to plunge in and make himself the owner of property, make himself the controller of capital, make himself the absolute arbiter of his own destiny. We find our social organization so built up that we are all more closely related to each other and more dependent upon what the other man does. Therefore, in working out any plan of progress we must bear in mind the fact that such changes have occurred.

Now what shall we do in view of these changed conditions? One thing that might be called attention to out of a great many important things that happened during the war is price fixing controlled by the Government, national management, and things of that sort. These are

all significant, they all have an influence in our future plans and methods. It seems to me that the most significant thing of all that occurred during the war, the most forceful action so far as our future life is concerned, was the draft and the exemptions that went with it. You remember that the actual site of conflict in this great war was three thousand miles away, and there was hardly any one that believed that any foreigner could successfully attack this country and get a foothold on our soil. Only the most patriotic among us thought that it was the duty of the United States at the very beginning of the War in 1914 to organize an army and send it to Europe. But suddenly the United States passed a draft law and it said to you and to me, "Your whole future is in our hands even to the extent of your giving up your life. You belong to us, you are under our orders, you are no longer a citizen perfectly free to do what you please within the limits of ordinary law and order." They went further than that, they said to some of us, "You stay here," and to others, "You go there, prepared to give up your life if necessary," or, "If you stay here you must do certain things of a certain kind that are necessary to the progress of the war." Again, it went further still, it said to those who went there, "You are under a certain discipline and you must accept a certain nominal wage for your efforts." As to the class that remained here at home, conditions in connection with their work were utterly changed. The wages of labor went up to a point they had never reached before. The net result of that was to make what we call the laboring class in the community a select class. If you will look deeply enough and analyze suffciently closely I think you will find that that was not entirely a correct position to take; but nevertheless the popular idea was that there were certain classes in the community that were so valuable that their lives could not be put in jeopardy, so necessary was it that they be kept at work. Now that idea then formed has persisted after the close of the war, it has been carried over into our present conditions in peace.

On the other hand, we did see men of wealth and position, men who could not work with their hands, giving up large incomes and relatively comfortable lives, renouncing things that they wanted to do and taking up the most onerous duties in the service of the nation in connection with the war, and receiving for it relatively little pay. To

many of such men greater recognition is due than to a great many of the workers in this country. But at the same time we have this great class that we call 'labor" who have been raised to this position dominated by the old idea that you have heard so often expressed that they are the people who make the world, the men who work with their hands, that they are the people who make for progress and are somehow or other of more importance. So that there has been a certain revision of our standing in our democracy which will eventually be worked out; but so far as the present is concerned, those are the conditions.

Now how are we to act in the solution of our local problems in view of this great upheaval of the social organization, in view of this social unrest, in view of these aspirations of certain classes of our communities because of certain treatment that they have received during the war, which, as I said before, is nothing but an acceleration or emphasis of what was taking place in the ordinary progress of industrial society?

Well, I am going to close with just a few suggestions. In the first place, I think it will be very wise indeed to remember that this is an age of propaganda, this is a time when a large number of people have seized on some idea that they think is going to revolutionize the world and make it better all at once and for which they are coming to us for support. Now blind resistance to that sort of thing is futile, because while they are not all right it would not do for us to say that they are all wrong, nor would it do for us to say that any one of them is wrong. Any one of them may have something in the way of a general idea or general plan which they propose which may be of service although it would not do to accept it at once. You all know in your own organizations the enthusiastic individual who gets an idea and immediately wants to put it into operation. If he has the right material in him you have to change him, transform him until you increase his judgment; or if that is not possible you have to eliminate him altogether. Under these circumstances we have to keep our eyes and our ears wide open; we have to realize that this is a time of change, of flux, and that there is no escape from it; but at the same time we have got to keep our feet on the ground and remember that, after all, the world never has made any great progress by revolution but only through evolution, by slowly working toward its ulti-

mate goal; and that while we may have deviated here and there from the direct line of progress, nevertheless progress proceeds more or less along fixed lines. We are perfectly willing as we go along to make use of this or that idea after we have carefully studied it and carefully weighed its possibilities and considered its relation not only to immediate action but with a view to what may be the result a year, or five years, or ten years, or even more than that from now. Many of our troubles to-day would not be with us, of course, if that plan had been pursued.

While I am not foolish enough to think that any one is possessed of wisdom, or far-sightedness, or brains sufficient to properly measure the effect that some action now will certainly produce some ten years later, nevertheless we may profitably study present conditions with an eye to the future always.

I think, however, that sometimes in addition to keeping our feet on the ground we should realize and understand more definitely our own position to the community. The people talk of us as "public servants," but I think there is not always a clear understanding by everybody as to just what that means. We are, after all, business men; we are in this business, and we can confess here and elsewhere that we are in it to make money for our stockholders, for our employees, and for ourselves. We are going to make that money properly, and as much of it as it is possible to make, by fair dealing with all of these consumers, employees, stockholders, and ourselves. If we give good service, if we sell at fair prices, and proper prices, we are in no whit different from the man down the avenue who sells furniture or who sells shoes; if he doesn't do the right thing by you you go to his competitor. But the point is, our business will suffer if we do not conduct it in a business-like way. Therefore we have to regard ourselves as business men, we have to come out into the communty as such, and we have to eliminate from the minds of so many people the idea that we have some sort of a gold mine in the cellar, and teach them that we have to make our profits out of what people pay us.

That is the trouble with the railroads to-day, that somehow or other the people think they will run anyway whether they are given proper support or not. We have got to carry to the community the idea that we are out and out business men, selling a product, selling service that

we desire to be of the very best and most satisfactory character, but which cannot be kept up to its highest standard without proper financial support from the community.

And finally, let me say in conclusion that what this country needs more than anything else, gentlemen, is to have preached to it from every street corner and by conversation by every one of you with all of those with whom you come in contact the sound doctrine of the necessity for thrift, for saving. We have prided ourselves in this country upon our boundless national resources, including the wealth of the mines in the bowels of the earth; a large part of that wealth we have destroyed or used up, if you please; it is no longer here, and we are now dependent for a large part of our wealth on the same system that had to be adopted by France, Germany, Italy, and all of those older civilizations in Europe, that of saving—thrift. We have got to get the people of this country to thinking more of what they save and less of what they spend. If we do that, many of our problems will be solved.

You hear all around you talk of socialism, Bolshevism, and so on. You hear men talking about property rights and personal rights; but gentlemen, let me tell you now that after all property rights are at the basis of our social organization, and that man is a better citizen, a more stable citizen, who knows that he has a stake in the community, whether it be Liberty Bonds, or the securities of some good industrial or public utility company, or a piece of land with a house on it. That man then feels that he has something that he can call his own, and because of that fact he will be a better citizen, he will re-act to the proper impulses. Therefore our whole effort should be to get people to keep their Liberty Bonds, to own their own property, to save enough so that they will have something ahead, then they will resent any man's coming around and telling them that there are no property rights, and many of the problems that seem to be before us to-day will cease to exist.

I thank you very much for this opportunity. I am glad to be here this first time I am with you as an Association. I hope in future years I shall again have the great pleasure of renewing my acquaintance with you.

I thank you. (Applause).

President Oppenheimer: We are deeply indebted for the splendid address that Mr. McClellan has given us, and which has hit the nail on the head. It has been very enlightening covering a subject that is vitally interesting to all of us in this period of reconstruction following the great war.

FOURTH SESSION—WEDNESDAY AFTERNOON, JULY 16, 1919

The convention met pursuant to adjournment, the President, Mr. I. L. Oppenheimer, in the Chair.

Mr. Charles P. Garman, Chairman of the Meter Committee, presented the report of the Committee, as follows:

REPORT OF THE METER COMMITTEE.

The Meter Committee has carried on its work this year with two open meetings and while this plan was a success under the conditions that existed, we want to recommend more open meetings to the Meter Committee for the coming year.

The first meeting was held in Cleveland on December 6, 1919, in the club rooms of the Electrical League, at which time Mr. Kermode presented the very timely paper entitled "Conservation in the Meter Department" (printed in the February, 1919, number of the O. E. L. A. Bulletin). The representatives present were guests of the Cleveland Electric Illuminating Company to luncheon served in the club rooms of the Electrical League. The afternoon session was given to a round table discussion on problems of interest to meter men.

The second open meeting was held in Dayton at the Engineers' Club on April 18, 1919. The morning session was devoted to a report by Mr. Wright entitled "Training Men for Meter Work," copy following in this report. The afternoon session was devoted to a report by Mr. Byrant on "Scheduling Service Tests on Small Capacity Meters," also printed in this report. Both of the above mentioned subjects are very active at the present time and deserve considerable discussion.

The Meter Committee wishes to extend a vote of thanks to the manu-

facturers for their hearty co-operation in helping us make this year a successful one.

The following report by Mr. Wright of Toledo, will serve as an excellent suggestion to all who are interested in training men for meter work. The recent crisis we all passed through has taught us that slip-shod methods of training can no longer be tolerated. It might be of interest to mention in this report that the National Meter Committee are working on a course for training meter men that will be put up similar to their course in Practical Electricity.

THE TRAINING OF MEN FOR METER WORK

By Mr. J. L. Wright, Toledo, Ohio

The relation of the meter and the meter system to the central station company is a factor of great importance, the gravity of which has not as a rule been fully realized in the past.

A great amount of attention has always been given to the power plant, in seeing that the generating equipment is of such efficiency that the generating cost per kilowatt hour is as low as possible, but very little attention was given to the efficiency of the Distributing and Meter Systems until the past few years.

The revenue of a central station is dependent upon the meters in a number of ways, and the continued accuracy of the meters is a matter that materially affects a company's financial success. It is therefore, necessary in order that the proper remuneration be obtained for the product supplied that not only care be exercised in the selection of meters, but that a means be provided for the proper maintenance of the meters.

There are several things that are essential to the proper maintenance of meters, chief among which is the provision of men who are competent to carry on the work, for no matter how extensive the mechanical equipment may be, very little can be accomplished without the aid of men who thoroughly understand the operation of such equipment.

The provision of the proper men to carry on the work necessary, is a task of no mean proportion, for it has been found that it is almost

impossible to obtain men who have adequate experience to enable them to carry on the different classes of meter work, and most companies have, therefore, found it necessary to employ men with little or no experience in the work, and train them for the particular requirements of the company.

Although it generally is not necessary that applicants for employment in the meter department have had any previous experience in this class of work, or electrical experience of any nature, there are certain requirements that the apprentice should have before given employment, and care should be exercised in the selection of men. Such applicants are usually interviewed by the head of the department before being given employment, and by the aid of careful questioning, it can be usually ascertained as to whether or not the applicant is of the proper caliber for the work.

It generally takes from one to two years to train men so that they are capable to handle certain classes of the work properly. It is obvious, therefore, that the applicants selected to take up the work should be those who are liable to be the kind that are not in the habit of becoming dissatisfied with their occupation, and are continually changing from one class of work to another.

Other requirements to be considered are education, physical fitness and personal appearance.

The general policy seems to be to select men who have had at least a grade school, or preferably a high school education, the requirements of the work being such that much better results are usually obtained when men having rerceived this class of education are employed, although excellent results have some times been obtained from men who have not completed their grade school course.

Since it is necessary to train men for this work, it is necessary that some sort of a routine be followed, in order that the best results be obtained, in order to accomplish this, most large companies have a training course which the apprentice has to complete before being adjudged competent to do meter maintenance work.

The method of training may change with different companies on account of their individual policies and requirements but such a course generally consists of training in all classes of meter work, such as repairing, shop testing, standardization work, tester's assistant, testing on consumer's premises and installation work.

The apprentice is usually started at work in the repair department where they are given instruction in meter reading, are taught the names and functions of the various essential parts of the meter and their manner of assembly, after having received this elementary training, they are allowed to make simple repairs under the supervision of the person in charge of the work, and as they advance, are allowed to do all classes of repair work.

The experience gained in the repair department, is always considered of great value to the apprentice, as he is given the opportunity to study the make up and characteristics of the various classes and types of meters being used, and it is to the advantage of the department as well as the apprentice that these opportunities be brought to his attention.

The training in shop testing consists of being taught the different test formulae, the proper manner of connection for the different types of meters, and the manner of making the proper adjustments, after which the apprentice is placed at testing the smaller capacity of induction type meters, then he is given training in the testing of Direct Current and Polyphase meters.

The experience gained in the shop testing of meters, with the exception of learning the testing formulae and manner of making the different adjustments, is not generally of much value on account of the fact that most test laboratories are so arranged and equipped that the work of testing becomes very much mechanical excepting in instances where special investigations and tests are being made. While testing meters in the shop, the apprentice is usually given some training in standardization work, being made acquainted with the use and connections of the various classes of indicating instruments.

The apprentice having satisfactorily completed the course in shop

work, is usually transferred to the outside testing division, being first placed with a tester engaged in testing of large capacity meters. While on this work, he receives instruction as to the service connections of the different types of meters and instruments, and becomes acquainted with the actual service conditions. After having become familiar with the work, the apprentice is usually allowed to handle the actual testing of some of the meters under the supervision of the tester.

A large number of companies have both direct current and alternating current service, and the testing of the large capacity meters on each class of service is sometimes handled by different testers. In instances such as these, it is considered a good policy to transfer an apprentice, while he is acting as helper, from one class of testing to the other, in order that he become familiar with both classes of the work.

The training received while acting as helper in the outside testing division is of great importance, and much depends upon the tester with whom the apprentice is working, as to whether or not he makes the proper progress. It has been found that under some testers, the apprentice fails to make much headway, while under others, they will make very good progress, due to the fact that while both testers may be very proficient as far as testing is concerned, they may have entirely different personalities, one not giving the apprentice the proper attention.

The apprentice, after having served as helper in the outside testing division a sufficient length of time, and having shown the proper progress, is usually placed at testing small single phase induction meters on consumer's premises, being first sent out with an instructor, whose duty it is to see that the apprentice is competent to carry on this class of work, and the apprentice having been adjudged competent is classed as a tester.

The progress made by the man after he has completed the training course, and having been placed at testing the above mentioned classes of meters, depends largely upon himself, and in order that the department keep informed as to his ability and progress, it has been found a good policy to make check tests at frequent intervals, such tests tend to show whether or not the tester is carrying on the work properly and whether or not he is making the proper progress.

The testing of meters of one class of service is liable to become more or less monotonous, and the men become more or less mechanical when engaged in one class of work for any great length of time, and good results have been obtained by rotating the men if they show the proper ability so as to allow them to test the different classes of meters.

In meter work as well as in any other class of work, much depends upon the individual as to whether or not he becomes successful. There are a great many things that cannot be taught in actual work which are to his advantage to be familiar with, and which he must become acquainted with through individual study. It is to the advantage of the department that the apprentice be given an opportunity to be able to obtain such information, and very good results have been obtained by furnishing outlines of short reading courses covering subjects upon which the men are working daily.

These reading courses should embrace parts of the Meter Man's Hand Book, articles from Standard Meter Test Books, and descriptive matter on specific types of meters and instruments from manufacturers bulletins, etc. A small library is usually furnished where such reading matter is available.

A number of companies are actively engaged in social and welfare work among their employees, and in connection with such work either conduct educational classes or recommend that the employees enroll in night or correspondence school courses. Some offer a bonus for those who complete such courses at or above a certain grade. Such classes or courses are always a source of benefit, if entered into with the proper spirit and completed, to both the employee and the employer for usually whatever knowledge is gained by the man is repaid the employer in better work, and in the fact that the man's field of knowledge or training is broadened, thus making him a more valued employe.

It is hardly possible to outline a course of training which would suit the purpose and requirement of all companies, as some give the men a more extensive training, and the requirements of others are such that they do not consider it necessary to train men in all the branches of meter work.

The course outlined below is one which is not intended to meet the requirements of all companies, as this would be impossible, but is one which is thought that with the proper application of the men and proper co-operation of those in charge of the work, will train the men in up-to-date standard meter practice, and fit them to take care of the work in the proper manner.

OUTLINE OF TRAINING COURSE.

The course is to be divided into six—three-month periods, each covering certain phases of meter work as shown in the schedule.

In each period, the student should be given practical work and in addition a prescribed reading course covering the work being done.

Each week at least one and a half hours should be devoted to personal instruction by the instructor. This should consist of talks pertaining to the practical work, as well as questions and answering of questions pertaining to both the work and reading course.

General instruction to students should be given by the more experienced men for each class of work and special instruction by a regular instructor appointed for this purpose.

In addition to this, the student should attend regular meter department monthly meetings at which talks and lectures are delivered, covering all phases of meter work.

A complete record of all work done by the student and personal instructions given him must be kept throughout the training course.

A careful analysis of the personal traits of each student should also be made.

Oral examinations ought to be given each month and a full written examination at the end of each training period. Students will be graded on both oral and written examinations and must show satisfactory progress before being transferred to the next higher class of work.

Outline of Training Course

First Three-Months Period

Repair Department Instruction

Reading of meters.
Makes and types of meters.
Names of various parts of meters.
Assembly of meters.
Methods of detecting defective parts.
General instruction in practical repair work of all types of—

Single phase induction meters
Direct Current meters.
Polyphase meters.
Field testing equipment.

During the third month the student will be expected to do regular routine repair work.

Reading Course

Elements of Electricity from Applied Electricity for Practical Men —Rowland.

Fundamental Principles, chapter 1.
Electromotive Force and Ohms Law, chapter 2.
Magnets and Magnetic Flux, chapter 3.
Principles of Electricity Meters, special parts of chapter 3, Meter Man's Hand Book.
Descriptive data of parts and the assembly of parts from Manufacturers' Bulletins.

Second Three-Months Course

Shop Testing Instruction

Testing Formula.
Connection of meters.
Manner of making adjustments.
Inspection and cleaning of various parts.
Checking of registers.
Testing small single phase induction meters, Single Board.
Testing small single phase induction meters, Group Board.
Testing direct current meters, Single Board.

Testing single phase and direct current meters, all sizes and types under service conditions as reproduced in shop.

During the first six weeks of this period the student should test new meters for the most part, during the latter half of the period he will do routine shop testing of all sizes and types of single phase and direct current meters, preferably those which have been removed from service and those that have been repaired.

Reading Course

Specified parts of Jansky's electrical meters.

Watthour meter testing, Meterman's Hand Book, chapter 7, special parts.

Constants and Test Formulas, Meterman's Hand Book, chapter 15 complete.

Descriptive Data, Meterman's Hand Book, chapter 16 complete.

THIRD THREE-MONTHS PERIOD

The first two weeks of this period, the student will act as a helper to a meter installer engaged in the installation of small single phase and direct current meters.

The second two weeks, the student will act as a helper to a tester engaged in testing single phase meters on consumer's premises. Connection and location of meters.

Connection and location of meters.

Connection and location of test instruments.

Duplicating service connections for test.

Routine of test.

Cleaning and adjusting of meters in service.

Making out of test reports.

Instruction in the handling of test instruments.

Relation of the meter man to the consumer.

During the second two weeks, the student will act as a helper to a competent A. C. tester, after which he should be assigned to the testing of small single phase induction meters under the supervision of the regular instructor who will make checks at frequent intervals.

During the latter part of this period, the student will be expected to handle routine field testing of all sizes and types of single phase induc-

tion meters and should also be given instructions in the method of handling consumers complaint tests of high registration.

Reading Course

Meterman's Relation to the Consumer—Meterman's Hand Book, chapter 1.

Testing on Consumer's Premises.

Periodic Testing of Meters, (reasons for, etc.) Meterman's Hand Book, special parts, chapter 7.

Statistic of Meter Tests, Meterman's Hand Book, chapter 10.

Auxiliary Equipment for Testing, Meterman's Hand Book, chapter 9.

Test Procedure, T. R. & L. Standard Instruction.

Specified parts of Jansky's Electrical Meters.

Published papers pertaining to the periodic testing of meters.

FOURTH THREE-MONTHS PERIOD

The first month of this period, the student will act as a helper to a tester engaged in the testing of direct current meters on consumer's premises.

Connection and location of meters, vibration, external magnetic field, creeping, etc.

Connection and location of test instruments.

Duplicating service connections for test.

Routine of test.

Loading devices—battery and resistances.

Instruments—rotating standards and indicating instruments.

The second and third months of this period will be devoted to instruction in shop testing of polyphase meters—maximum demand devices, and to secondary standardization work.

Connection of polyphase meters.

Adjustment of polyphase meters.

Various methods of testing.

Testing all types of polyphase meters.

Use of current and potential transformers.

Connections, checking and adjustment of maximum demand devices.

Checking of rotating standards.

Checking of portable indicating instruments.

The student should be under the direct supervision of the regular instructor during practically all of this period.

Reading Course

(Meterman's Hand Book)

Measurement of Electrical Energy, chapter 4.

Laboratory, Standards and Instruments, chapter 5.

Meter Shop, chapter 6.

Meter Testing, specified parts of, chapter 7.

Maximum Demand Devices, chapter 17.

Specified parts of Jansky's Electrical Meters.

Descriptive data concerning polyphase meters, maximum demand devices, laboratory and portable instruments from manufacturers' bulletins.

Fifth Three-Months Period

Field testing of polyphase meters and maximum demand devices, acting as a helper to a tester engaged in the testing of polyphase meters and demand devices on consumer's premises.

Installation and proper connection.

Methods of checking connections.

Test and adjustment of watthour meters and demand devices.

Routine inspections and checking of demand devices.

Power factor measurements.

Graphic wattmeters.

Indicating—integrating demand meters.

Recording—integrating demand meters.

During this training period the student should receive general instructions from a competent tester and will be executed to do the routine work necessary under the supervision of the tester.

Before being transferred to the next period of training, the student should receive additional instruction from the regular instructor.

Reading Course

Specified parts of Jansky's Electric Meters.

O. E. L. A. 1918 Meter Committee Report on Demand Meters.

Articles from Manufacturers' Bulletins.

Installing, testing and repairing of switchboard instruments in power stations.

Indicating—Integrating—Graphic instruments.

Testig and adjusting relays.

Special testing-motors, rotary converters, transformers, etc.

Meter department records.

Service, stock, accuracy records.

Monthly reports.

Demand records.

Test records.

Time studies.

Routine of customer's orders.

Reading Course

General reading course covering the above subjects as specified.

Scheduling of Service Periodic Tests of Small Capacity

INDUCTION METERS.

Five years ago our business, like that of many other industries, was getting along very satisfactorily on the whole. To be sure, there was always a changing condition to be foreseen, and there was the ever present problem of labor and its various moods, its restlessness, and consequent "turn over" with the continual question of how best to select and keep efficient workers,—for hereupon rests the success of any enterprise. However, the aims and purposes of our lives and business were being worked out without any very serious obstacles or challenges, when suddenly, and before we could realize what it all meant, we were confronted with the world at war. First, we assured ourselves that we were safe, and could go about business with little or no interference. But soon we too had cast aside as non-essential everything that was not contributing in some measure toward the winning of the war, and we entered into the spirit of the day. Men all about us, employees of experiences, and those who could ill be spared, left to others their responsibilities, and set out to help in the larger work of the country. Help became scarce, wages and material commenced to climb in price; you know full well how the central stations were ofttimes taxed to their

limits to meet the increased demand for more power: their business boomed. However, the added work had to be accomplished by fewer men at a greater cost, and this was capped with an increased scarcity and poorer quality of coal, not to mention other needful supplies. The rates having been fixed, and contracts for most services having been given on a peace-time basis, and with no upward revision possible except at the approval of the Public Commission—representing a public already exasperated with uncontrollable advances of almost everything needful to life—and with a money market tight, the central stations found themselves in anything but an enviable position. Nevertheless the war had to be won no matter to what extent the sacrifice, and the central stations were an important element in the industrial performance of this task. All non-essentials had to be cut out or deferred; even many things that previously had been looked upon as essential had to be set aside for the time. Periodic testing of meters was one thing that could thus be deferred, and the labor and expense thereby relieved could be used to fill in the dangerously yawning gap in departments with more imperative needs.

All periodic testing, however, could not be deferred without more or less irreparable losses in revenue. In the case of the residence class meter however, we have not only the largest percentage of the total number of meters, involving a large share of the cost of maintenance, but therefrom is derived the smaller percentage of the total revenue. Consequently, in practically every large central station the periodic testing of residence or smaller capacity induction meters has been partially or entirely discontinued for the period of the war, with exception of such necessary tests as are required by complaint investigations or on account of verification of questionable registrations at the request of the Billing or Accounting Departments.

Now that the armistice has been signed, and war activities are rapidly declining, we are fast approaching, or have already arrived at, the time when we must again pick up the work which was temporarily deferred. However, we have in the meantime come to look upon many things in a new light and from a broader experience, so that we are asking ourselves and one another,—What changes should be inaugurated and what improvements are possible? We do not wish to return to the pre-war methods and conditions except insofar as such shall be found to be the best and most satisfactory.

Since we are finding meters with extended periods between periodic tests still registering their loads within their required limits, such questions as those naturally confront us: How much longer could these service periods between periodic tests be extended without the occurrence of serious errors? What should we try to establish as the most suitable period between tests?

If such a period can be safely extended one or two years, say from three years to four, or even five years, it would decrease the costs of such tests from 35 to 40%. Assuming for the moment that this saving thus made should be but half this amount, it represents an economy well worth our consideration.

One large central station to our knowledge has at the present time over double the number of meters in service to that of five years ago. In contrast with this, the total number of meters tested this past year was less than 40% of the number tested five years ago. Even if, with the return of peace conditions, this company were to receive back all the testers it has lost,—which cannot be expected—it would fall far short of what would be required to maintain its pre-war schedule of tests. It takes time to secure and properly train men to the point that they are capable of handling satisfactorily the tests on customers' premises. What should we recommend to this company, and others similarly situated when they come to us for advice?

Should we recommend extending the intervals between tests of the smaller capacity induction meters to—shall we say five years, or what?

Should we include in this recommendation all modern makes and types of induction meters or ought we to qualify this in certain cases?

Should we recommend that an inspection with an approximate load test be made after say 60 to 75% of this period has elapsed?

Should we recommend a careful consideration of all meters in this classification which show a questionable deviation from the normal monthly registration to be followed up with a test if a satisfactory explanation is not readily obtained therefor?

Should we advise the changing of meters within this class for laboratory or shop tests where the operating company shall find itself incapable of making service tests after an elapse of shall we say .... years? Is this latter method going to prove acceptable to the company or customer as representing the service accuracy of such a meter?

Should we strive to maintain the small capacity induction meters

within the same limit of accuracy as those involving larger revenues? If not, what should be the limit? Note: The cost per test differs but little between the meter with a monthly average revenue of but $2.00 to $3.00, from that which runs into hundreds of dollars a month. A 5% error in the first case represents a loss in revenue very much less than 1% in the latter.

Do some makes and types of meters have causes of error different from those of other makes and types? If so, would it not be advisable to establish the interval of service between periodic tests, taking also into account the type and capacity of the meters involved, rather than to base the same on the meter capacity only, irrespective of type?

Should the average cost of test and the approximate average yearly revenue have any influence in the establishment of the service period between periodic tests? If so, how should the same be applied?

With such questions as these in mind, the writer desiring to ascertain what might be the status of some of the larger central stations in respect to some of these matters, prepared a simple questionnaire which he sent to twelve meter superintendents in various parts of th country. Nine replies were received, which, together with the writer's, makes ten. Following is an attempt to summarize their questions and answers:

1. Regarding the normal pre-war intervals between periodic tests in the case of the smaller capacity induction meters: Two reported that they had been following a twenty-four month schedule. One reported that they had been following a thirty-month schedule. Six reported that they had been following a thirty-six month schedule.

2. The question was asked as to why these particular schedules were adopted rather than some other. The answers were quite varied in nature. Two attempted no answers at all; one, who reported a twenty-four month schedule for small A. C. meters, replied that when the schedule was adopted there were several new types of meters being placed in service, and they were somewhat apprehensive of their performance over a long period of time, so that they felt that a test at least every two years was warranted from the point of being assured that they were properly maintaining the meter accuracy. Another states that their schedule (a thirty-six month) was adopted because a great many other companies had adopted this same time interval for small

capacity residence type A. C. meters. Two laid the burden upon the State Commission, claiming that the schedule for residential meters was adopted by their Public Utility Commossion, "probably after comparison with other commission rules, and investigation regarding the performance of meters." Still others reported that in the case of A. C. meters the schedule was not originally established on any definite basis so far as the accuracy of the meter is concerned, but it was started on the theory that all meters should be tested once a year, but this was soon found to be unnecessarily often, due to the large number of O. K. tests; so that this schedule was accordingly lengthened as far as it was thought to be safe considering the accuracy obtained and revenue derived from these meters.

3. Answers to the question whether it had been possible to maintain these schedules uninterruptedly up to the first of this year, shows that in the case of each of the ten reported, none had been able to maintain such schedules, while at least four stated that they had practically abandoned for the time being all periodic testing of residence meters, one adding that "the Billing Department kept a pretty strict watch over the monthly bills for the small customers, and when the bills showed any abnormal fluctuation from either the previous month or the corresponding month of the previous year, they made a special investigation, and in case they were unable to discover anything which satisfactorily accounted for some fluctuation, they tested the meter."

4. As to the intention to return to the pre-war schedules of testing residence meters; four replied to the effect that such was their intention. One replied that they contemplated trying to have their schedule for small capacity induction meters changed from thirty to thirty-six months, giving as their reason that they thought these meters would give good results on the longer schedule. Three replied that they did not contemplate returning to their pre-war schedule. It is the opinion of the writer that these latter were not so required by their State Commissions while the others were.

5. With a view of ascertaining if there might be any approximate relation between the error occurring in a meter and the million of turns of the moving element, the question was asked: "Have you any

data showing the relation between shaft turn of the moving element and the relative accuracy of the meter registration?" Seven answered that they had no data on this subject. One sent curves made up which showed that when but a few meters were considered, the relation seemed to be rather erratic.

I would like to quote from the reply of one who has evidently given this matter considerable thought and study, in which he writes: "It is rather difficult to obtain any definite relation between shaft turns of the moving element and the relative accuracy of registration. With sapphire jewels, the jewel has a very considerable influence on the accuracy of the meter but the curve of deterioration is not a straight line. We found that our accuracy was very much improved by arbitrarily removing sapphire jewels at each periodic test and having them repolished and our schedule was made, as before mentioned, largely upon the expected life of the jewel." (The reference thus referred to is: "The D. C. schedule was based originally on the basis of revolution of the disc, as at that time we were using sapphire jewels which had a considerable influence on the sustained accuracy of the meter. We are now using diamond jewels but are still retaining the 12 months' limit of these meters and unless the use is very light, I do not believe it wise to lengthen it.")

Continuing he adds: "It made considerable difference in the wear of the jewel, whether the meter was running at high speed or at a comparatively low rate. With diamond jewels the deterioration is practically all in the shaft end, and compared with the other sources of trouble, is practically negligible. From the data I have compiled on the C. S. type of meter, the deterioration in accuracy seems to be a function of the time the meter is in service, or rather the time between periodic tests rather han a function of revolution; but the rate of change is not sufficiently uniform in the meters so far tabulated, to allow us to base our test accurately even on this factor. With the A. C. meter, from the little data we have compiled to date, there does not appear to be any relation whatever in actual practice between the sustained accuracy and the length of time between periodic tests. In other words—the average accuracy of a block of meters allowed to run 48 months appears to be practically the same as that of a similar block of meters allowed to run 12 to 24 months. We are compiling data of this, but as yet have not enough available to make showing conclusive."

The writer has been compiling data covering several hundred meters grouped according to make and type. His data bears out the conclusion expressed in the above, to the effect that it thus far affords little upon which to help establish an efficient interval between periodic tests. Probably the most striking conclusion to be reached from this compilation is that no period was reached which showed a decided tendency for deterioration of accuracy. Possibly when the tests cover longer intervals between tests, this characteristic may appear.

6. The last question in the questionnaire, previously referred to, aimed to bring out, if possible, some relation between the average cost of testing and the average revenue derived from any class of meters, it read: "Do you consider it practical to try to establish the test period by taking into consideration the average cost of test and the approximate value of revenue saved through corrected accuracy?" In answer to this, the party previously quoted, writes: "In spite of what I have said in the foregoing, I think that for D. C. meters approximate curves of increasing errors could be had that would give some indication of the errors to be expected under certain conditions and that it would be possible to apply these curves, taking into consideration the average cost of test and the approximate value of revenue involved through correction of accuracy, to make it worth while. It would be considerably more complicated than our present method of arriving at test periods. For meters that are outside of what would be commonly known as small use meters, we have used for years a method which roughly approximates this idea, but in addition meters which show a decided tendency to fall off in accuracy, due to either its location or to the use to which it is put, the period is shortened. One complication with A. C. meters is, of course, the weakening of the magnet which can hardly be allowed for." Another answer reads: "From our data I do not believe it is practical for us to test meters on the basis of shaft revolutions. There is one weakness I see in this method. Most full load errors are due to change in magnet strength due to aging or short circuits. This has no bearing on shaft revolution." This has been brought forcibly to my attention on the test we are now making of meters which we had extended to the four-year plan. Still another writes: "We feel as though satisfactory results can be obtained by arranging a test schedule primarily based on the capacity of meter." Contrasted from

this, showing considerable diversity of opinion expressed, another writes: "The average cost per test and the approximate revenue saved to correct its accuracy should be considered in making up a test schedule, but consideration should also be given to maintaining meter accuracy. By this I mean that I consider it good policy to set a time interval whereby we test the meter before the revenue commences to decrease because of slow meter, then to set a time interval whereby we are almost certain to find meter running slow."

The general conclusion gathered from these very interesting replies may be very briefly stated as follows:

1. The pre-war schedule for periodic tests of the smaller capacity induction meters was in most cases 36 months. No longer periods have been indicated.

2. A few, if any, of the larger central stations were able to maintain this schedule for this class of meters during the war. A number of companies practically abandoned periodic tests on meters of this class during the war time conditions.

3-4. Those companies operating under State Commissions, which have adopted definite ruling pertaining to the testing of meters of this class, are endeavoring to return as rapidly as possible to their former schedule of tests.

Those companies operating under more liberal ruling are not contemplating, for the present at least, the return to their pre-war schedule for this class of meter. The reason for this change seems to be based on the opinion that tests made after extended periods show no increased tendency to error over those taken after the previously shorter periods.

5-6. Little or no effort appears to have been made to arrive at a period between periodic tests for meters of smaller capacity from an analytical, systematic or economical basis.

After considering the problem of extended intervals between periodic tests, I would like to present the following suggestions for your consideration:

Since the general accepted period between periodic tests on the residence class A. C. meters is given as 36 months, and since it is the ex-

pressed opinion of not a few that this period can be safely extended by one or two years, I accordingly would recommend to the members of this Association:

1. That a thorough inspection be made in place of the usual 36 month test and that where the inspection raises no question as to the accuracy of any given meter, its test be set at 60 months. (24 months after the inspection.)

2. The adoption of the following, where it is not already the established policy, to the effect that all cases of unusual changes in monthly registration be investigated and where there shall be no satisfactory explanation therefor, that a thorough inspection or test be made at once.

3. That the inspections above referred to (Sec. 2) should cover:

(a) General external conditions, such as condition of wiring, seals, etc.

(b) Approximate stop-watch or watthour standard check of the meter on a standardized 60-watt load.

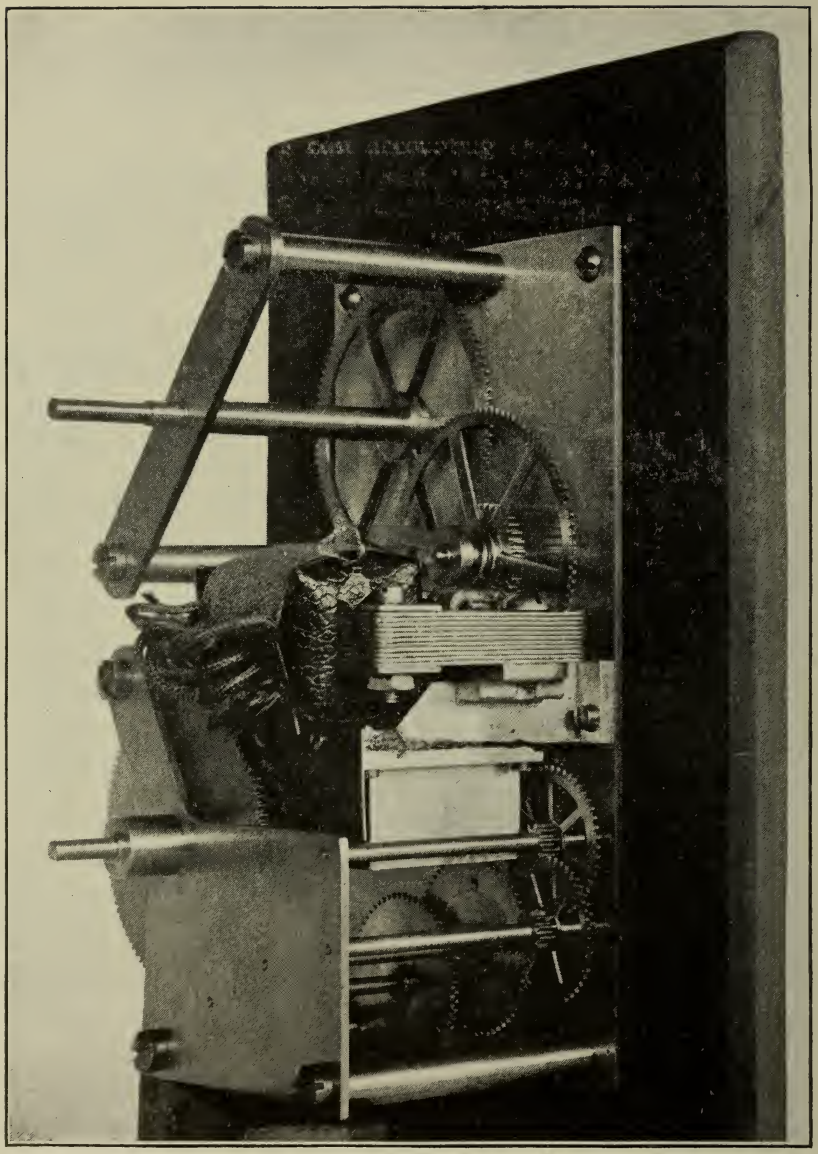
(c) Where this check shall show the meter accuracy to be within 4%, the meter may be opened, the jewel cleaned and oiled or replaced when rough. The top bearings of such meters as show characteristic friction at this point may be cleaned and oiled, the magnets and disc cleared from any foreign matter.

(d) The meter to be again sealed, dail reading recorded.

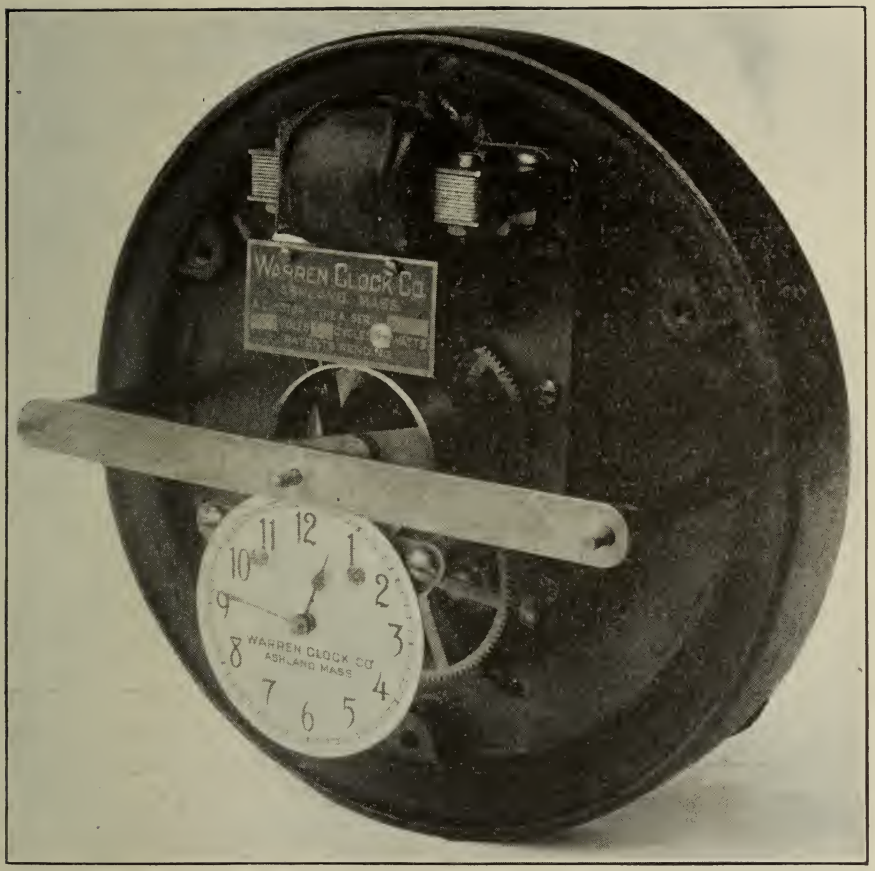
(e) Where the 60-watt test shows the meter to be found in error over 4 or 5%, the meter should be again checked on this load after general inspection and cleaning. If it still is shown to be over 4% in error, the meter should be scheduled for test.

(f) Normally the last feature of this inspection should be a 10-watt or starting load taken to insure that the meter has no serious light load error.

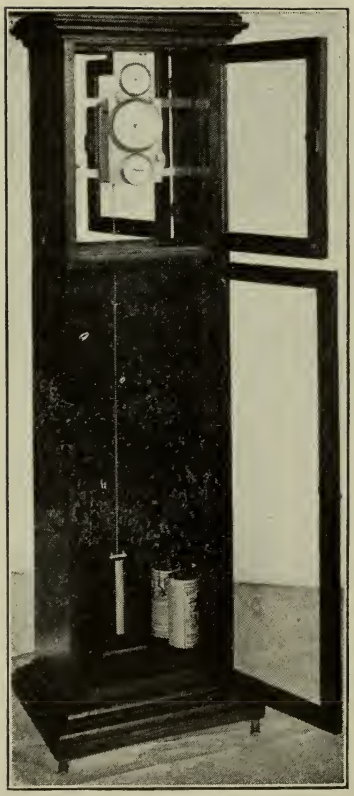
It is the object of this report to bring to your attention the possibilities for progress along these lines and it is the very earnest hope of the writer that a thorough discussion may follow from which we may all profit much.



Cut No 1---Warren Motor Clock adapted to the G.-E. Type "G-2" Demand Meter.



Cut No 2.---Warren Motor Clock and G.-G. "P-2" Demand Meter Clock



Cut No. 3-- Master Clock.

Maximum Demand Meters

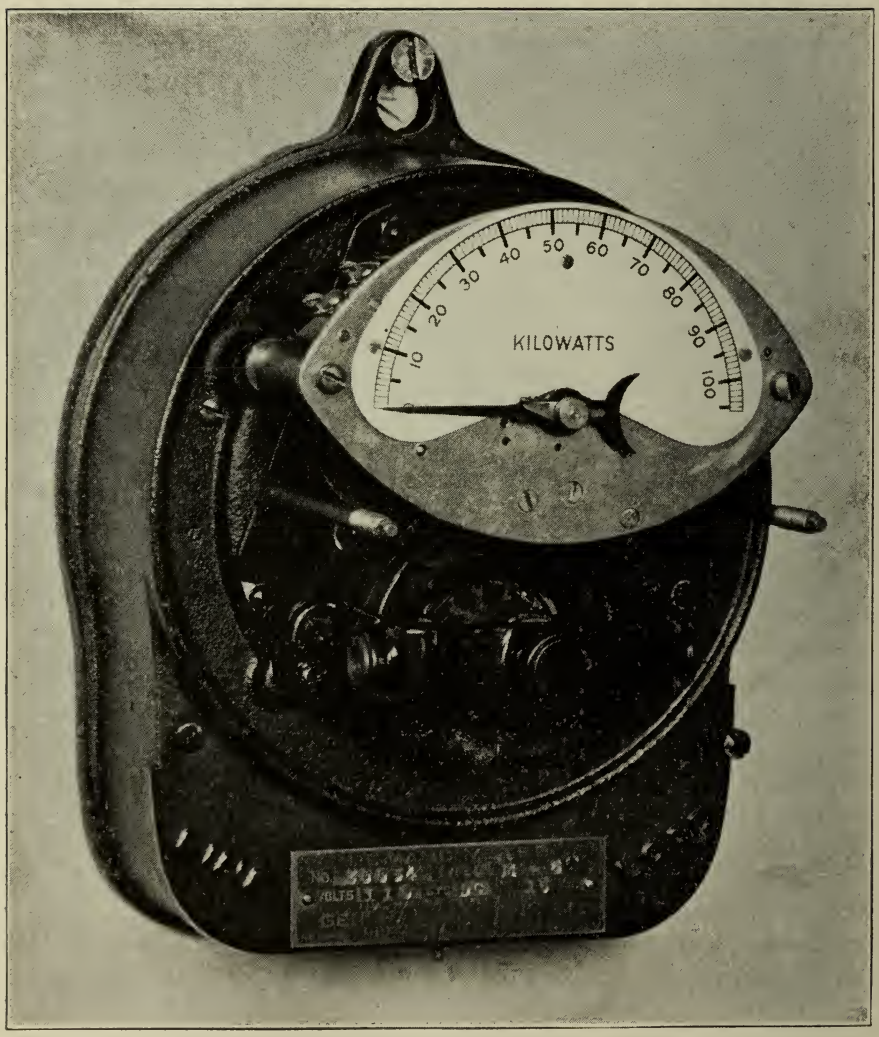
Your committee made a survey of the large manufacturers and report that very few new devices for measurement of maximum demand have been developed in the last two years. There are several new applications to some of the existing types of demand meters which we felt were worthy of mention in this report.

One very interesting application which undoubtedly is a step in advance, is the Warren Self-Starting Synchronous Motor Clock. This clock is adapted to several types of demand meters, including some graphic recording meters and can be readily installed in place of the old escapement clock. The operation of these clocks, as reported by several member companies, has been very successful and, it is also reported, they require very little attention.

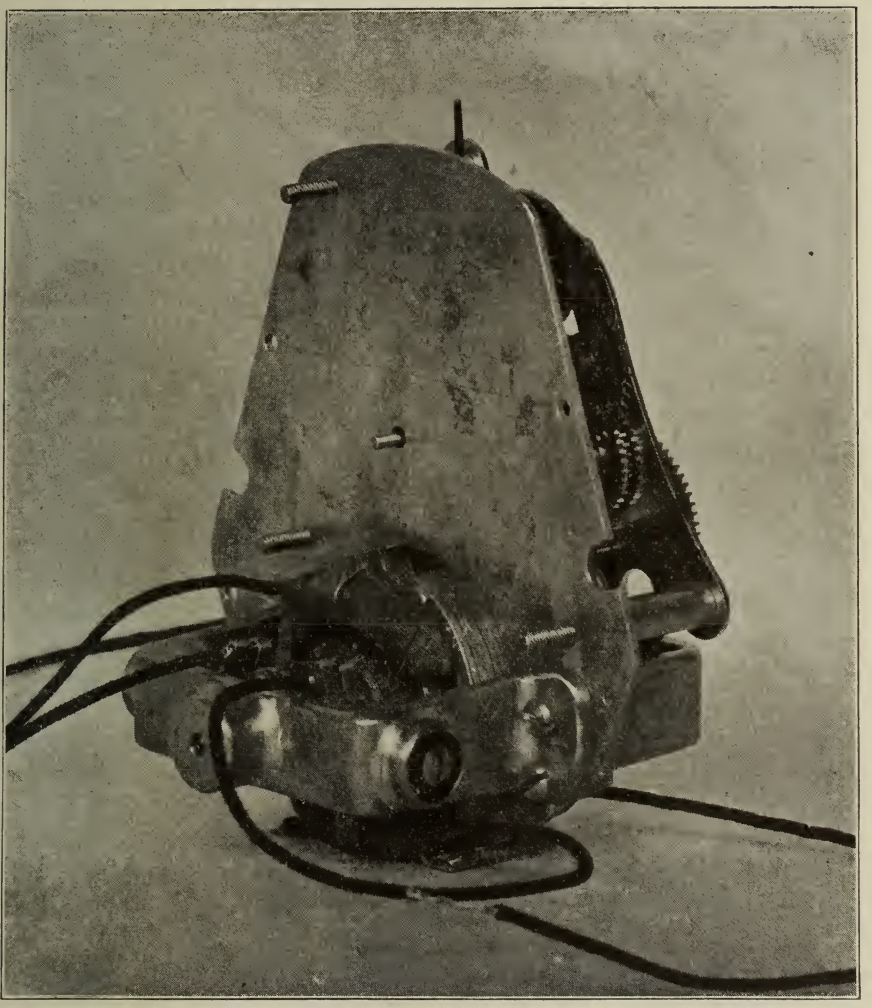
In order to obtain the best results with these devices, the station frequency should be regulated to a master clock which consists of a very accurate pendulum clock operating in combination with a Warren Synchronous Motor Clock. It has been found a very simple matter to keep the station frequency regulated to time simply by keeping the two hands together on the Master Clock.

The General Electric Company reports a welcome addition to the M-5 demand meter in the nature of an electric self-winding clock. The motor is connected to a source of direct current and excited at all times. When the torque on the main spring decreases a small amount, the motor rotates, thereby rewinding the main spring back to a balance.

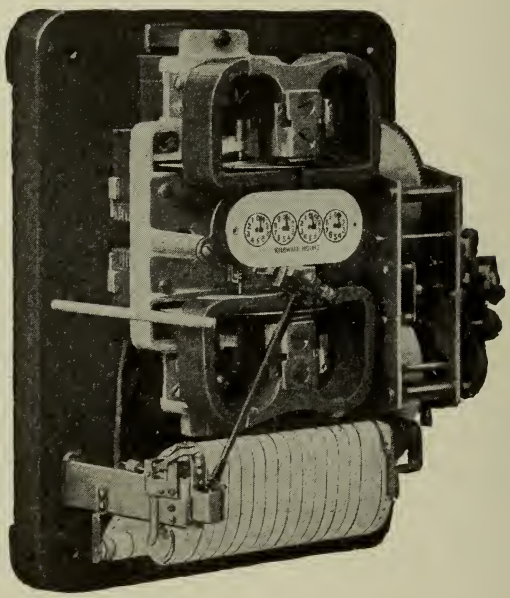
The Westinghouse Company report some changes on the RA meter, one of which is the addition of the continuous inking device. This consists of a small ink well carried on the left hand side of the paper feed which has an arm actuated off of the driving roll. This arm dips into the ink well every few hours and raises a small amount of ink which siphons into the pen each time the pen returns to zero.



Cut No. 4---"M-C" Demand Meter, "G.-E. Co."



Gut No 5 ---"N-6" Demand Meter, Rear View of Electrically Wound Clock.



Cut No. 6---Westinghouse Co Type "R-A" Demand Meter.

A change has also been made in the paper feeding device and the right hand side of the paper is now punched oval shape to allow the paper room for expansion and contraction.

Respectfully submitted,

C. P. GARMAN, *Chairman.*
J. L. WRIGHT,
J. T. KERMODE,
Meter Committee.

Discussion

Chairman Garman called attention to the fact that as to certain types of instruments referred to in the Report the same were on exhibit downstairs, so any one desiring to do so could examine them.

President Oppenheimer: Gentlemen, the Meter Committee has prepared a very exhaustive and comprehensive Report, the salient features of which were brought out by Mr. Garman. We will now take this Report under consideration and would like to have some discussion upon it. We would like to hear from Mr. Henton, of Akron, if he is in the room, on the subject of training men for meter work. Is Mr. Henton present? Can we hear from Mr. Kermode?

Mr. J. T. Kermode, Cleveland: In view of the fact that the Report was submitted in three parts or sections, I think it would be advisable to discuss each subject separately as submitted in the Report. Therefore I will confine my remarks to the question of training meter men. I believe that Mr. Wright should be congratulated on the manner in which he has outlined a course for meter testing; yet I cannot say that I thoroughly agree with the plan as submitted. Experience has shown that it is very difficult to train meter men; and in view of the fact that there are only a few companies in the State that are equipped and have the organization to train meter men along the lines as suggested. I believe that while the plan will work all right with the larger companies, the smaller companies will have to depend upon getting men from the larger companies as they are trained. Consequently the larger companies will be always called upon to educate men for meter work. Years ago we were of the opinion that young men or boys just out of high school were the proper type of men to select for this work; but experience has shown that with that class of

men the labor turn-over is so great that it becomes a very expensive proposition to take in so many new men and train them for work as important as meter work. Therefore I believe that instead of taking young men it is better to take a man with a technical education and offer him a rate of pay that will be attractive and that will compensate him for the amount of time that he has spent in securing his education. On the other hand, you take a man with an ordinary school education and as soon as he reaches the point where technical questions come up he immediately loses confidence in himself and leaves you before he has really become of any value. I believe that the the larger companies will soon adopt the plan of taking older men for meter work rather than young men who only stay for a short length of time. I believe that we are better off to take a man that has been in some other line of work, say perhaps an arc light trimmer who has been with us six or seven years. Such a man is very apt to stay and you can better afford to pay that man a higher rate of pay while you are educating him to become a meter tester than you can a man that you take in and after educating him for five or six years have him leave you.

I believe that it would be a good plan for the meter men in the coming year to take up if possible the question of special meter courses in the high schools and in some of the colleges. Very little work of that kind has been attempted. It is of vital importance to the Central Stations that they be able to secure the proper type of men for meter work. I do not believe that the management of Central Stations recognize the value of competent meter testers fully. I think that their value should be based on the cost of replacing them rather than through making a comparison with some other class of workmen in the organization; and in addition, I believe that some form of compensation in addition to their regular pay should be allowed them. By that I mean, that some form of bonus measured on a quality basis and not on a quantity basis should be applied. If men are paid a bonus for the quality of their work and are selected from other departments in the organization I believe that the labor turn-over problem will be to a large extent solved and the cost of continually training meter men will be very much reduced. (Applause).

President Oppenheimer: Mr. Garman in the course of his Report made mention of some new developments or improvements that had been made to demand meters. I would like to call upon Mr. Hall, of the General Electric Company, if he is present, to give us a brief talk upon that subject.

Mr. Chester T. Hall, G. E. Co., Ft. Wayne, Ind: I believe that it is quite appropriate that I should first express my appreciation of the kind of work that your Meter Committee has covered in this Report. It seems to me that they have shown excellent judgment in selecting subjects that are vitally important and very timely. Mr. Garman made a rather veiled allusion to the fact that the manufacturing companies have been more or less asleep at the switch. I have to take exception to that because, as you probably all know, the manufacturing organizations particularly so far as their developmental departments are concerned have been very largely taken up with war work during all this period so that naturally the usual commercial lines have suffered to a certain extent. However, that is all past history now and we are going at full pace in all the various commercial departments. We have two interesting things that were very briefly touched upon in the Report; first, the application of the synchronour self-starting motor to the Central Station service as a means of furnishing clock time. There are two important points in this application; first, the device forms an inherently accurate frequency meter, probably more accurate than any other frequency meter that has ever been developed on account of the fact that its basis of operation is the counting of the number of cycles per second, or per five-minute intervals, so that it is very accurate as a frequency meter. In addition, although this is more or less of a side issue, there is the fact that the generator or the supply system is being regulated by means of a clock which is absolutely synchronous so that by connecting up the small self-starting synchronous motor of the type that we have on exhibit downstairs you have at any point of the system an absolutely accurate clock of the conventional form. That means that many of the spring-driven clock applications can be very advantageously substituted by one of these small motors which will give you with a minimum amount of trouble and the minimum amount of maintenance as accurate time as can be gotten. The regulator which determines both the measurement of

frequency and the synchronizing of time is a high grade instrument of the sixty beat type of regulator; so that you have a very flexible and very accurate means of keeping time. We have developed this motor into various replaceable units for record recording devices and other demand meter applications where time is an essential element.

The second new development is the N-6 Demand Meter manufactured by the General Electric Company. It is simply a spring-driven clock maintained in operation by means of a D. C. motor. This device is to be used exclusively D. C. and purely to replace the former hand-wound clocks, so that we have in this mechanism and equipment a synchronous motor mechanism which requires no attention, no winding. (Applause).

President Oppenheimer: Is Mr. Berger present? We would like to hear from him on the same subject.

Mr. Berger: Mr. Chairman, I have not much to add to what Mr. Hall has stated about the difficulties which manufacturers have had with their regular product or extensions due to war conditions. Electrical manufacturers like all other industries helped the Government. I want to say with regard to our Type "R-A" Demand Meter that the features are on the monthly basis which means that it cuts down maintenance expense inasmuch as you have to make only one trip to the meter at the time when you go to make the trip for the billing. The reservoir will hold several months' supply of ink. We have put on several improvements and have also put a hanger on top of the meter to make it easy for you to hang it up anywhere while you are testing it. The hanger slips down when you actually install the meter.

We are also proceeding with a development of what you probably know as the Lincoln Thermal Demand Meters. We put out about one hundred hand-made samples with some of the largest operating companies in order to gain actual field experience. We know what the meter will do based on the tests which we have conducted in our laboratories, but we would rather have these results confirmed by experience on the part of your companies. We are satisfied that the results will be satisfactory, and we hope to place the meter on the market some time this fall. We have had a number of other devices brought to our attention by Central Stations and other operating men. We are playing with them

and I am not prepared to make any definite statement about them until we are prepared to furnish them to you a little later, when I will speak more on the subject. (Applause).

President Oppenheimer: Gentlemen, our time is passing rapidly and is somewhat limited, yet there is another subject covered by the Meter Committee's Report that we will have time to talk upon, and that is the scheduled service test on small capacity meters. If Mr. Schwartz, of Columbus, is in the room, we would like to hear from him. Is Mr. Wright present?

Mr. J. L. Wright, Toledo: Ladies and Gentlemen, I am a little surprised, as I did not expect to be called upon to discuss Mr. Bryant's paper. We have found it necessary to lengthen out our testing schedules. I believe all Central Stations have found they have had to do the same thing. We have not just decided upon a definite time interval. We are fussing with thirty-six months ourselves. I have nothing further to add to the discussion. Mr. Bryant had a very thorough paper and one which covered the subject very nicely. (Applause).

President Oppenheimer: Mr. Berger, can you give us any information on this subject?

Mr. Berger: Mr. Chairman, Ladies and Gentlemen, it is very surprising that in the past Central Station managements have taken so little interest in meter development. They have seemed to look upon it more or less as a necessary evil or over-head to their system; but the war and the high cost of labor and material has caused them to sit up and do some thinking, and they realize now that the meter department is the most important one in their industry. If they will stop to think they will see that the meter is the cash register of their business, the fountain head which determines the amount of their product and measures their revenue; so that they should appreciate its importance. Along these lines it seems that it would be very advisable to consider the type of meter and the nature of test applicable to it. The type of meter also may effect the interval of time between testing. You Central Station men should be in a better position than the manufacturers to make a decision with re-

gard to proper test intervals based on your experience. We know from the manufacturers' standpoint that our meter bearings, jewels, etc., will stand any amount of service for an indefinite time, you need not worry about that. If you solicit an expression from me as to the length of time between tests on the small meter, I will frankly state to you three years as very safe, and even four years. I believe that the Meter Committee of the National Association are considering recommending four years as the time for periodic tests for small meters. We have a number of statistics collected from Central Stations showing that $100,000,000.00 worth of electricity is sold in a year's time. That is a vast sum of money. If we were to assume that the meters on an average were running one per cent. slow there would be a loss of $1,000,000.00, a large amount when compared to the slight expense involved in testing meters once in three years. That is the way you want to look at it. What is the amount of expense for testing compared to the revenue you obtain from some large buyer amounting to thousands of dollars every month? Really, it sums up into a matter of local conditions, kind of installation, amount of revenue, type of meter, and other such local conditions as to which you have to be governed by actual past experience. (Applause).

President Oppenheimer: Gentlemen, our time for the discussion of this subject is up, and we will have to close the discussion.

We are very fortunate this afternoon in having with us one of Ohio's distinguished citizens who agreed to come and address us upon a very interesting subject that is still fresh in the minds of all, the recent war. He is a man who has taken an active interest in local, state and national civic affairs; a man who has been a Representative in our State Legislature and in our National Congress; a man who is known throughout our country and who has served in the past two years abroad with the American army.

It gives me pleasure to have the privilege of introducing to you Col. Ralph D. Cole, of Columbus, Ohio, who I am sure will entertain you. Ladies and gentlemen, Col Cole! (Applause).

Col. Cole addressed the convention as follows:

WAR EXPERIENCES

Address by Col. Ralph D. Cole, Columbus, Ohio.

Mr. President, and Ladies and Gentlemen of the Association:

If the "call of the wild" is as irresistible as the call of the waves, the lover of the jungle must be fettered with fascinations more impelling than the siren's song. People do not come to Cedar Point to indulge in the deep problems of trade or of state. As a rule, they come not for light but for levity; not to ponder over the deep problems concerning the nation but rather to take a plunge in the cooling waters, enjoy the fragrance of the breezes, and to commune once more with nature as we did in childhood days; and therefore, recognizing that important fact, it is no part of my present purpose to impose long on your patience this afternoon.

Your President informs me that he had invited the Bakers to attend this session. That is eminently fitting and proper. If you contemplate a permanent organization, I would suggest that you call it "The Light Bread Association." (Applause). You will find it mutually advantageous. You can make your bread as light as you choose without popular discontent, and you can charge as much "dough" for your light as you please without public disapproval.

Mr. Chairman, it is recorded that God said: "Let there be light! and there was light." When God speaks, the universe obeys; and at that command the sun burst forth in full-orbed splendor, the stars sparkled in the deep blue of heaven's dome and the planets not to be outdone, beamed with borrowed luster; and the first great lighting plant of the universe was in full operation; and seeing that that light plant came like a drop of sand from the outstretched hand of the Almighty, I have oftentimes wondered why it was that light travels in straight lines and is not able to light both sides of matter at the same time; and why, in the Almighty's battle against the powers of darkness he allowed the night to take refuge in the rear of the planets; and I have come to the conclusion that it was a part of the eternal plans of Providence.

God did so much, and he expected man to do the rest. He illumined the entire universe, but on the other side of the planet he allowed darkness to reign. Had it not been for the swamps for man to drain, for the mountains for him to climb, for the oceans for him to navigate and

for the continents for him to conquer, man would still be a beast in the jungle. The men who have been engaged from the earliest times in the illumination of the dark places of the earth have been carrying out the Divine command; and no one can measure the amount of happiness, comfort and well-being that has come to the human family by reason of the services of the men who have been engaged in the production of light. It was one of the original commands. While you think of profits in connection with illumination, yet you are following out the Divine command, for crime cannot live where light endures, and you are driving crime, and want, and unhappiness, from the dark places of the world as you go forth on your mission of illuminating these places.

Mr. Chairman, during the last few years the world has not only been engaged in the physical illumination of the dark places on the globe but also in illuminating the dark places of despotism, the dark places of autocracy; and there has been on this globe the greatest battle in all human history in order to throw the light of liberty and freedom into the dark places of despotism and autocracy. America has been engaged in that work for the last two years. We sent a Division from Ohio; and as this is an Ohio organization, it shall be my purpose this afternoon in my few remarks to give you an account of the stewardship of the 37th Division of the Old National Guard from the state of Ohio.

We first went down to Camp Sheridan in the state of Alabama. They received us there with open arms. I want you Ohio citizens to know that the good people of the South threw open their homes and their hearts, and Southern hospitality was never warmer nor more generous than when it welcomed the boys from the North. Of course we have learned of the old civil strife and of the bitter feeling that existed between the North and the South during and some time after the Civil War; but when we saw the way they rose up and greeted us boys from the North, the warmth of feeling and the cordial reception that they gave us, we realized that the old bitterness and sectional animosity had departed from this land forever and that we were once more a national Union following out and realizing the dream of Webster when he said: "One Nation, one flag, one destiny!"

We went into camp and took up the serious work of preparing for duty on the other side of the sea. Along in September, 1917, there were drills of eight or ten hours a day. The boys were trained how to

shoot, how to handle the gun and bayonet, and the artillery was trained how to lay a barrage. Everything that was essential in modern warfare was taught to the boys down in the Southern camps. It was a serious time; but there were some humorous things in connection with our experiences. I recall that about the first of December, 1917, I was put in charge of issuing furloughs for the boys to come home. Along about the holidays they were very anxious to some back and visit their families and eat their Christmas dinner in Ohio. They learned that there were one or two things essential to coming to Ohio; first, they must have a foundation for a furlough; there must be sickness in the family, or there must have been a death in the family, or there must have been important business to transact which required their personal presence in Ohio, or perchance if one of the boys wanted to marry a sweet Ohio girl, these were the exceptional conditions that laid the foundation for a furlough to return to Ohio. Immediately there was great sickness in this state, (Laughter) and telegrams began to pour in; and strange to say, I knew there was an intense militant spirit of national unity in Ohio, but I never dreamed that it would express itself in the same identical words. The telegrams began to arrive, the boys would rush up to headquarters and flash those telegrams in my face. They would read like this: "If you want to see mother, come quick!" Did not say that mother was sick, did not say that she was at death's door, but just the bold declaration, "If you want to see mother, come quick!" Well, of course, I was filled with consternation by such a flood of telegrams indicating such serious conditions in the state; but I suggested to some of the boys that there was great similarity in the form of those telegrams; so they changed the form, and a few days later they began to roll in: "Come home at once; mother very low." One of the boys admitted that his mother was in the cellar when the telegram was written—quite "low!" Of course I had to get dear mother out of the cellar, so the furlough was granted.

I remember that I took occasion to come home myself along about the holidays; and when I was going back South from Cincinnati on the train a handsome stalwart soldier came and seated himself by my side. I asked him what the foundation of his furlough was. He said, "I went home to get married." I said, "Did you get married?" He said, "No; I didn't get married." I said, "Did you go home?" He said,

"No, sir." I said, "I am the man at Camp Sheridan who issues the furloughs." He looked at me, and as quick as a flash he said, "Well, do you know who I am?" "No," I said, "I didn't know." "Well," he said, "I am the biggest liar in Camp Sheridan." He said, "That girl had promised to marry me; but when I got up home she refused, and therefore it was impossible for me to consummate my contract with you." Another young fellow from Cincinnati went home to get married, and in about eight or ten days afterward I received this sort of a telegram from one of his friends: "Dick married last Tuesday; in very bad condition; unable to travel. Please extend furlough five days." Those were some of the humorous things that occurred in Camp Sheridan.

Mr. Chairman, there is a great deal of liberty allowed soldiers under those conditions; and even if they just exaggerate a little and get away with it, there is no military punishment for such an offense. The boys called it, "beating the game," and I have known some very respectable officers that have indulged in the same pastime. Seeing Colonel Hard back there I shall mention no names.

But along in June, just about this time of the year, the infantry was called to France, and then the artillery went over there in the lot, and left New York on the 28th day of June and landed in Liverpool on the 10th of July. Colonel Hard had command of the boat that we went over on, a valued member of your organization. We landed at Liverpool and were received with great applause by the British people, who turned out in Liverpool in uncounted thousands to bid us welcome. We remained there a day or so, and then entrained for Southampton. We landed in France on the 14th of July, the National Birthday of France, celebrated as a great day by them. If that had been this year it would have been the day before yesterday. We landed at Havre on the night of the 15th. I shall never forget one year ago this morning when we got off the train we were in Versailles, the little town where the peace treaty was formulated and signed. The only object in Paris visible from Versailles that morning was the Eiffel Tower; but during the entire night preceding we had looked out at the northern sky and could see the reflection of the cannons, the light of the cannons. It was not an agreeable sensation. We realized that at last we were coming

within the area of the sights almost and the sounds of war. That was the night of the 15th of July; it was the great artillery preparations of the Germans for their final assault upon Chateau Thierry; and one year ago this morning that assault was made. The Germans' final objective in that assault was the city of Paris. I have been told by Parisians that looked up at the northern sky, millions of Parisians stood out in the darkness and gazed at that northern sky that night expecting that the Germans would fight their way through into their city, and of course they would have done so had it not been for a Division of the Americans that the Germans ran into after the French had begun their retreat. I was talking just a few days ago with some American soldiers that assisted in stemming this assault. The Germans were so confident that they were going to walk through everybody else without opposition that they advanced with their rifles slung over their shoulders, and three or four French Divisions retreated and as they came back through this American Division they told them that there was no possibility of stemming the German tide and for the American Division to fall back; our boys had received no order to fall back and they stood their ground, that is just what they went to France for, they went to France to fight and not fail when the crucial hour arrived. So they just pulled off their coats and rolled up their sleeves and waded in; and they gave the Boches just such a blow as a certain gentleman received over at Toledo on the Fourth of July. The Germans went reeling back routed in utter confusion; and from the day that that first American Division hit the Hindenberg line the German army never advanced a single foot and the American army never retreated a single foot. Then after that affair we went over into eastern France and went into camp, and shortly afterwards we received an order to take over the front trenches in a sector in Baccarat. I was with the first detachment that went up to this sector.

Advancing toward the front for the first time is not a very agreeable sensation; you do not know how far those big guns are going to shoot. You do not know when the aeroplanes are coming back to drop their bombs. Our Commanding Officer gave us a circuitous route so that there was an air of mystery connected with our movements. I finally asked him what his object was? He said it was to throw the Germans

off our trail; all that precaution was quite uncalled for, for the Germans knew everything about our movements; they had a most remarkable system of espionage. When the 77th New York National Division relieved the 42nd or "Rainbow Division" in that sector, the Germans from one of their observation balloons in the rear of the lines displayed a painted streamer which read: "Good Bye, 42nd, Welcome to your graves, 77th!"—a rather uncanny greeting, we thought, for a new Division. When it arrived in the front line there was not a great deal of fighting there, it was mostly patrols out in No Man's Land; there was a sort of truce between the French and the Germans. If a German Division needed a rest, they went there for it. If a French Division needed a rest they repaired to this place for a rest; but the American boys did not understand that rule, and presently they had a complete command in No Man's Land and they would go over at night and beat the Germans over the heads. Next night the Germans would return the compliment. I never saw anybody that was so absolutely punctual in the performance of their social obligations as the Germans, they just returned those calls with unerring accuracy the following night. And so it was with the batteries, our boys would always go over and call on the Germans during the day-time, while the Germans would pay their respects at night. Along about nine or ten o'clock in the morning great flocks of aeroplanes would come back from the rear of our lines and as they got up at an angle of about 80 or 85 degrees the shells would begin to break around them. The first thing that we could observe would be half a dozen puffs of smoke, then you could begin to hear the reverberations of the bursting shells. After a few days the men learned how to duck and dodge; it was amazing the skill they acquired in keeping track of bursting shells; they could tell almost exactly when the next shell would burst, and so they made it a point not to be in that immediate vicinity at that time. They would return along about eleven or half-past and we would count them as they went over in the morning, and when we again made our count at noon it was seldom that they all returned. If it was a moonlight night the Germans would return the compliment between nine and ten o'clock, especially if the moon was shining; if it was a dark and cloudy night, impossible to see their objective they would not

come over; but if it was moonlight we could rely upon it they would come buzzing over; along about nine o'clock we would hear them coming in this direction, with a sort of an intermittent buzzing and in a few minutes you would begin to hear the bombs fall. The first night they came over they dropped one bomb in the barracks and killed six men and fourteen horses. Our boys were instructed when an enemy aeroplane appears in sight to get under cover, get into a trench, get into a building, get into a cellar, anywhere to get out of danger; but the American boys wanted to see them flying up in the air, so they would come out and many of them lost their lives by reason of taking unnecessary risks.

Shortly after that, along in the early part of September we went over towards the Argonne and brought up at a little place called Bar Le Duc; from there we were transported out into a sector in the Argonne. Twenty-four thousand Infantry troops were transported in 24 hours between sixty and seventy miles into the Argonne over the great national highways of France. If it had not been for the great national highways of France civilization would have been lost in the first assault upon Verdun. Whenever this Association has an opportunity to boost good roads and to insist upon a national system of highways built upon the theory of national defense, you will be discharging a patriotic duty to your country if you take that position (Applause), because it was through those great national highways, it was through the motor transports that men, munitions and supplies were carried out of Paris and up the great Paris and Verdun highway and concentrated along the lines at necessary points under the command of Major Joffre and saved the original assault upon Verdun. I had little respect up to that time for the organizing capacity of the French. They operate along different lines from the Americans; they have a different language, different in their deportment and different in character; and their mental processes different. I observed that when a half dozen Frenchmen met they would all talk at the same time. The conversation would proceed in that way for some time, until all at once one Frenchman would say, "Bas!" and another would say, "Bas!" and another one, "Bas." Good! Good! Good! and a conclusion was reached and they went and performed their duty. Half a dozen Americans

would take the same matter up in an orderly way, one man would express himself, then another, but in about the same length of time they arrived at the same identical point, reached the same conclusion and each would go to discharge his part of it. It was just a difference in the mental processes. The mind of the Frenchman works zig-zag like lightning. The American will strike the light and go directly to its objective. But when I saw the French transport 21,000 men sixty miles by motor transport in 24 hours without the loss of a single man, into the forest of the Argonne, I felt that America was justified in turning the supreme command over to Marshal Foch, the great Marshal of France.

That night, the 25th of September, the bombardment began. I went up through the sector during the afternoon before in order to reconnoiter the roads. I looked in the faces of the boys that afternoon; there was no mirth or merriment there; there was no levity or hilarity; there was a set expression of invincible determination. There was a gleam from eyes that could not be conquered. They realized what they were advancing against, the Prussian Guard. They realized that before another sun should set that hundreds of their comrades would lie in death, thousands more to be wounded by shot and shell; but there was no such thing as lack of resolution on the part of those lads from Ohio; and the next morning they took their place in the trench between the hours of three and five, after the greatest artillery preparation in the history of the ages. I have read John Clark Ridpath's History, where he says that in the Battle of Gettysburg two hundred heavy guns belched destruction and shook the hills with their terrific thunder for two long hours. Why, do you know that along that American line up in the Argonne there were ten thousand heavy guns of all calibers belching destruction and shaking the hills with their terrific thunder from eleven o'clock at night until five-thirty in the morning? Why, the very air seemed to be alive with shells; it was simply indescribable; it seemed like the very spirit of death and destruction was whirling through the clouds on its mission across No Man's Land; and then from behind that terrific barrage in the morning the boys went "over the top!"

Let me present a picture to you of the terrain over which the boys charged on that historic morning. There was an old abandoned French trench extending through the little town of Avocourt, what had been a

little village during the earlier days but of which there was now nothing left. It had been pounded into powder by the ceaseless cannonading over a period of four years. The boys took their position in that abandoned French trench, partly filled with mud and water. Across this shell-torn field there was acres and acres of barbed wire entanglements; up yonder 150 or 200 yards there was an old abandoned German trench twelve feet across, filled with barbed wire. Beyond that, more barbed wire entanglements. Every 500 yards in the Argonne forest there was a concrete machine gun emplacement, or what the boys called "pill-boxes," well reinforced with concrete. They were eight or ten feet in diameter, and right in the top there was a little opening or little slot which allowed a machine gun barrel to protrude. These were placed at advantageous places where one attendant could sweep the entire front. Now picture that condition! Into that barbed wire entanglement, into that awful terrain, into that machine gun fire, those boys plunged that morning; and no other nation, I believe could have accomplished what they did. The French had tried it two years before and lost some fifty thousand men and retired in disorder. It was only the wild unconquerable dash of the Americans that made the difference. It means something to be an American; it means that you cannot surrender; it means that you can die but you cannot surrender; it means that you must fight as long as you are able to fight; it means that you are upholding the dignity and honor of the greatest flag that flies in the skies; and that is the spirit that animated the boys as they plunged into that awful hell on that historic morning, sweeping the Huns back out of that region. That is what it means to be an American! (Applause).

My friends, that was the Hindenburg line; there was something fearful about the very name of Hindenburg. He came there fresh from his great victories of his armies in the East, and he had constructed that line of defense, their concrete machine gun emplacements, their rifle pits, their trenches, their dug-outs that they had built under the surface of the earth and they did not deem it possible for any force to drive them out. But I want you to know that those peace-loving lads from your state, those boys that never fought in a war until two years ago when called to the colors, those lads not professional soldiers, they drove the Germans out of their defenses, out of the Hindenburg line that had

taken the Germans four long years to construct, in four short hours! (Applause). They accomplished all of the objective set for them and they were relieved.

I have given you this description of the fighting on earth; but there was also fighting in the air, and there was fighting in the seas. All human knowledge gained through the centuries was applied to the destruction of property and of human life in this great war. And there was war in the clouds. I remember the first morning in the Argonne there were four observation balloons in the rear of the American line. The Germans had standing orders to shoot those observation balloons down every time they possibly could. So that morning it was not raining in France, contrary to the rules and regulations in such case made and provided; it always rained in France except that morning. I know it was raining the next morning, because Major Wilson told me of a little fellow who came up to him the next morning and said, "Major, what are we going to do now? You don't suppose they will start this fight in the rain, do you?" So I know that it was raining the next morning; but it was not raining on the morning of the 25th. I was in charge of some prisoners and I saw a great line of clouds overhanging the sky going far beyond the German lines and far back of the American line. A German plane had taken his position in the clouds calculating his distance with absolute accuracy. He worked out of the clouds at an angle of about 45 degrees from our first observation balloon. There are always two men in the basket that is suspended from an observation balloon. The first man when he saw the German coming jumped out, his parachute unfolded and he sailed away in safety. Just as the second man was about to jump the German fired into the balloon with an ignition bullet, the balloon caught fire and started down. The man jumped out, his parachute unfolded and he started on his downward course. Under those conditions the balloon is anchored to the motor truck and the motor truck pulls the balloon to one side so that it will not descend on the man that is going down in the parachute; but for some unknown reason the machine refused to operate and the balloon started down. I could see the man three thousand feet yonder in the air looking up out from under his parachute at the descending burning balloon. In a minute or two the burning balloon had collided with and set fire to the parachute and the man fell from it

three thousand feet through the air. First his feet were down, then his head and his arms, in every conceivable position. I turned my face away in agony and then looked back again and he was still falling—falling—falling—falling, until his form passed out of sight in the forests of Racecourt. I talked with the man the other day who buried him, and who told me that his body was nothing but jelly, bearing no semblance whatever to the human form. That is only one of the startling things out of thousands of startling things that occurred in the Argonne forests; but I cannot detain you with long descriptions of them.

I am going to take you on a five-minute trip up into Belgium, where we performed our last service under the command of the King of Belgium. After a journey of three days by train we found ourselves at the little town of Ypres, which had been a town of five thousand people prior to the war; now it was nothing but a mass of debris. I stood there in front of the ruins of a famous hall talking to a young British officer. He said that hall was one of the most famous places in all Europe, and that two hundred of his men still lay in those ruins and that Ypres was nothing but a monument to uncounted thousands of British and Belgian and French soldiers that were caught there like rats in a trap when the German bombardment began.

I have heard some criticism of French soldiers and of British soldiers, as to their fighting capacity. Before you criticise the French or British I invite you to visit Verdun; I invite you to Ypres; I invite you to recall a picture of the original assault of the Germans upon Verdun, and how old General Joffre, one of the most heroic fighters in all history, inspired the French army and the entire citizenship of France with one thought and only one thought: "They shall not pass! They shall not pass! They shall not pass!" And the French stood there and in uncounted thousands, inspired by that sentiment, paid the last full measure of the soldier's devotion to his native land.

Before you challenge the fighting quality of the French, I invite your attention to the fact that we never saw the flower of the French army—it was dead—it was dead! The boys of France were gone. Four-fifths of the boys between eighteen and twenty-three had given up their lives, a million and a half of them; and six million more had been wounded and sent to the rear in hospitals of agony and pain.

And so it was with the British, we never saw the flower of the Brit-

ish army, it was dead—sleeping beneath the poppies of Flanders. When we arrived 6,000,000 more had gone into the hospitals.

Let us not judge the nations by our individual experiences with individuals so different in language, in character, in temperament; but when you measure a nation you must study its general characteristics, you must look at the people as a whole, you must look at the achievements of France and Britain before we arrived and after, when you accord credit to the nations for the part they performed in this great conflict.

America only asks and is entitled to this credit, that we arrived in the nick of time. I do not think—I doubt seriously if Germany could have conquered the British and the French, but the British and the French could not have conquered Germany; in all probability it would have been drawn. When America arrived in the nick of time, it is to the credit of America and the American army in all of its branches, and to the militant spirit of the American people at home that we came to be the deciding factor in the greatest war in human history. We should have to our credit the victory that came as the result of that sacrifice (Applause); that is what America is entitled to. We crossed No Man's Land through the sector of Ypres up through the swamps with the British tanks lying on either side. The Germans had been driven perhaps twenty or thirty miles on the other side of No Man's Land. In France we fought in No Man's Land. In Flanders the Germans had been driven out.

I want to present to you now a picture of civilian life during the time of a drive. There is always an area as close to the center of the Division sector as possible, and everything essential to feed the line of fire moves up and down that line. I see the country boys advancing to take the place of the men who have been slain or sent to the front line. I see the artillery advancing, often under the cover of night, to take their place for the barrage for the following morning. Nothing to me looks so much like the decree of fate as the American artillery. As it advanced through the night, with the spirit of horse and rider seeming to reflect the invincibility of the cannon, why, I just fell in love with the whole cannon family; and then when they began to fire, when they began the barrage, well, they certainly did speak a glorious language. But when their volleys came from the opposite direction, ah!

when they were coming your way, there was an opposite story to tell! Some fellow said to a colored soldier from the state of Alabama, "What do you think of the cannoneers and the cannonading?" "Well," he said, "Boss, they sure do talk to you all, yes, sir, they sure do speak to you all!" "What do they say?" "When they is comin' at you they just simply say, 'Youse never goin' to git back to Alabam!'" And those who have heard the shells with their little whirling "OOee," and then "Punk!" know that the colored man had certainly been within sound of an approaching shell more than once. The sector is crowded with artillery, ambulances, and everything essential to keeping up the line of fire. Ah! I can see it yet this afternoon, the intense excitement over the long line, the little crowds of civilians with little wheelbarrows and perhaps packs on their backs, streaming back along that line. When the drive begins the civilian population find their way into the cellars. None of the men are left, only the women and children, the aged and the infirm. They go into the cellars. I have talked with women and children that had remained in cellars for from five to seven days, without food, remained there praying to the Almighty God to save their lives while the shells battered in the roofs and tore down the walls of their buildings; remained in there until the shell fire had ceased, until the machine gun fire was gone, and then those that still remained alive came out and worked their way back along the line.

I see that line advancing this afternoon; yonder is the aged mother, wringing her hands in agony; a shell has just fallen upon her house and killed her aged husband. One of the twenty-five men remaining in the little village of Cruys Hautern is pushing a wheelbarrow with a little casket, and following it are other wheelbarrows with a like burden. These are the little children who have perished; they are bearing them off to the hillside for burial. Here I see a family of seven children, father and mother; two of the children five hundred yards up the line had been struck by a shell and torn and mangled beyond recognition and were lying there stark in the sunlight. A great gaping wound was in the mother's side which meant death in a few hours. That is war! That is war! That is war!

When I saw the stream of the civilian population, the men and the women and the children, coming back along that line, I thanked God that America had the courage, the patriotism, the hard sense, and the

bravery, to go abroad and fight this terrible war rather than wait until the Huns landed upon American soil to despoil and lay waste our country, and murder and maim our women and children. Thus, my friends, has America been saved by the fighting of that war on the other side of the sea. We advanced to the rescue of civilization; America cast the deciding vote in that mighty conflict.

I trust that in shaping the treaty of peace and formulating the future international policies of the world, that wisdom may so inspire every action that the seeds of future conflict may not be sown in that historic document, as the seeds of future wars have been heretofore sown in practically every treaty for centuries past. Let us study that document, let us look into its conditions and provisions and let us see that justice is done to men and nations so that the torch of freedom shall illumine the pathway of the nation as it takes action on the most momentous question since Washington and his compatriots laid the foundation of the Republic. Unsullied is our position, unsullied is our duty towards ourselves and the nations; and let our conduct as individuals and as a people be such that the Republic shall be what its founders declared it should be, the light of all the world and the highest hope of humanity. (Applause).

Secretary Gaskill: I know that we are all profoundly gratetul to Colonel Cole for his wonderfully inspiring and patriotic talk. An appropriate vote of thanks will be given at this time for such expression in our convention.

President Oppenheimer: The convention will now adjourn to meet at 8:45 in this same room, to hear the lecture by Mr. Durgin.

The convention adjourned accordingly.

FIFTH SESSION—WEDNESDAY NIGHT, JULY 16, 1919

The convention met pursuant to adjournment, the President, Mr. I. L. Oppenheimer, in the Chair.

The speaker of the evening, Mr. Wm. A. Durgin, was introduced by Prof. Caldwell, and delivered his lecture on Illumination.

The lecture was illustrated by lantern slides and was enjoyed by the large audience, among whom were many ladies.

The lecture was followed by the Exhibitors' Carnival and dancing.

Adjourned to 10:00 A. M., Thursday, July 17, 1919.

SIXTH SESSION—THURDAY MORNING, JULY 17, 1919

The convention met pursuant to adjournment, the President, Mr. I. L. Oppenheimer, in the Chair.

President Oppenheimer announced that the order of the program for the morning would be reversed, in that the address of Mr. Eeagleson would follow instead of preceding the Report of the Illumination Committee. He stated further, that the registration had now reached 435, the largest registration that the Association had ever had up to Thursday morning at any previous convention.

President Oppenheimer then introduced Prof. Caldwell, Chairman of the Illuminating Committee, who presented the report of that Committee. He remarked at one point aside from the report as follows:

I have found myself somewhat embarrassed this year with the triple relationship as head of the Electrical Department of the University, as Chairman of the Factory Lighting Committee, and as Chairman of the Illumination Committee. I have found myself dealing with myself in various embarrassing ways I am glad to state that the idea of making this a University Extension movement was due to Mr. Doane, the former Chairman of the Illuminating Committee, who has continued to take an active interest in the work of the Committee.

At another time Prof. Caldwell said, referring to the meeting for Association lighting men and other Association members that was held on the 14th inst at Nela Park, Cleveland, by invitation of the Engineering Department of the National Lamp Works of the General Electric Company, said that the meeting was not as well attended as might have been desired, but was of a highly interesting character and well worth the time given to it by those who did attend. Prof. Caldwell believed, however, that it had proved a mistake to attempt to hold this meeting at Nela Park on the day preceding the opening of the O. E. L. A. convention inasmuch as many members who attended the O. E. L. A. meeting came with their wives and families in machines and did not care to take the detour to Cleveland. He thought it would have been better to have

held the Nela Park meeting entirely independent of the date of the O. E. L. A. convention.

The Report of the Committee on Illumination follows:

REPORT OF THE ILLUMINATION COMMITTEE

I. The Campaign for Improved Lighting

The efforts of this committee during the past year have been chiefly devoted to carrying on a campaign for better industrial illumination. Several circumstances have combined to focus the attention of the industrial world upon the subject of illumination and thus to make the present time especially appropriate for this undertaking. Among these the following may be mentioned:

(1) The improvement of light-sources both as to efficiency and effectiveness. The recent development in light-sources has so reduced the cost of light that it is often feasible to provide intensities as great as or even greater than average daylight. The recent establishment of the R. L. M. standard for industrial reflectors has greatly simplified the problem of the selection of equipment and of the design of lighting systems.

(2) The increasing appreciation of the importance of providing the best practicable working conditions for industrial employees. Cheerful surroundings and good lighting go far toward making the comfortable and contented workman, and he is one of the best assets the manufacturer can have. This has come to be especially true in these times of social unrest.

(3) As a consequence of this movement, the promulgation of state factory lighting codes calling for a prescribed minimum intensity. These also disseminate some elementary information on the principles of good lighting. Some remarkable figures on the relation of lighting to industrial accidents have been published, and are quoted in the third policy letter of this committee to Association Lighting Men. These show that about 18 per cent of industrial accidents might be prevented by good lighting.

(4) The longer hours of factory lighting brought about by war work conditions, 8-hour shifts, etc. The latter has resulted in some cases in the use of two 8-hour shifts in the place of the former single shift of 10 hours.

(5) Last but not least, the growing conviction, fostered by such painstaking cost investigations as those now being carried on by Mr. Durgin in Chicago, that not only good lighting, but even extra-good lighting pays through the greater production which results therefrom. As brought out in the "technical letters series" increased production of from 10 to 35 per cent resulted in four of these tests.

It did not require much study of the situation to convince the committee that in spite of the ancient and honorable arc lamp upon our badges, there existed a notable lack of working knowledge of modern lighting practice among the engineering and sales forces of our member companies. This state of affairs the committee undertook to improve by several means.

Principal among these has been the correspondence courses on industrial lighting. On January 1st a letter was sent to all member companies, calling attention to the situation as above outlined and asking each company to appoint one of their sales-engineers as their accredited "Lighting Man." To each of the fifty-eight men so selected two series of communications have been sent, known respectively as "policy letters" and "technical letters." Up to date four of the "policy letters" have been issued and two more are in course of preparation. These have to do with the commercial aspects of the sale of industrial illumination, and are intended only for the members of the Association.

The technical letters, as the name implies, deal in an elementary way with those features of the science and art of illumination which are needed for the successful design of industrial lighting installation. This course consists of twelve lessons of which six have already been sent to the lighting-men.

The committee had not gone far with this series before they realized that these technical letters were just what was needed by many engineers outside of the Central Station field, who were in one way or another responsible for factory lighting.

Believing that they would come with more force if they were not published in the name of the lighting industry, the committee arranged with the Department of Electrical Engineering of the Ohio State University to undertake their production as a sort of university extension movement.

Considerable publicity has been given to these letters in the technical

press and a prospectus succeeded by two follow-up letters is being sent out to an extended mailing list of industrial engineers, contractor-dealers, architects and others. To make sure that the matter shall be kept up to date, only a small edition has been printed and the orders received indicate that the supply will soon be exhausted.

The price, fixed to barely cover the cost of printing, is $2.00. The Association is paying this charge for the copies sent to the Association Lighting Men. A unique feature, which while greatly reducing the cost of this series, goes far to insure its being kept up to date, is the use of extensive reference to technical trade literature. Such material is unusually good and abundant in the lighting field. The manufacturers of lamps and lighting accessories have co-operated most cordially in furnishing their publications for this use.

The six letters so far published deal with the following topics:

(1) Introduction, fundamental concepts and definitions, (2) Lighting requirements, (3) Lamp and lighting units, (4) Reflecting and diffusing accessories, (5) Illumination Design, (6) Illumination Design, continued. Each letter is accompanied by questions or problems to be worked out by the lighting student. The Department of Electrical Engineering of the Ohio State University has undertaken to correct and return the solutions sent in by the lighting men and all those who had been accredited by their companies were invited to undertake this as a regular task. Thirty-three accepted the responsibility. The Engineering Department of the National Lamp Works, General Electric Company, kindly offered a prize for the best set of answers sent in covering the first six technical letters. The result of this contest is announced elsewhere.

Another plan of campaign provided for a series of meetings for the Lighting Men and other Association members. To get the benefit of certain speakers outside the committee, this series of meetings was held on three successive days, April 9th to 11th, in Columbus, Toledo and Akron. With the exception of one local speaker at each meeting, the program was the same throughout. The morning sessions were announced as for Association men only. After a talk by Mr. G. S. Merrill of the committee, discussing the commercial aspects of the undertaking, a short address was given by Mr. Geo. W. Hill, who was

kindly delegated by the Society for Electrical Development, to assist in this series of meetings. Mr. Hill urged the importance of pressing forward the campaign for industrial lighting at the present time. The remainder of the morning sessions were occupied with a general discussion of the problems to be met.

For the afternoon meetings a general invitation had been extended to contractor-dealers, architects and others interested. The programs were as follows:

"Illumination Design," in which some of the essential elements of the problems were illustrated by means of examples of different types of lighting units. H. H. Magdsick, Engineering Dept., National Lamp Works of General Electric Company.

"Co-operation in improving industrial illumination," in which the need for co-operation with others in the electrical business was urged, and methods discussed. The work in this connection of the Society for Electrical Development, New York,

"Illumination measurements," in which the principles and methods were generally discussed and several types of illumination measuring instruments demonstrated. F. C. Caldwell, Ohio State University.

Short addresses were also made at the meetings in their respective cities by

W. A. Wolls, Columbus Railway, Power and Light Company.

W. E. Richards, Toledo Railway & Light Company.

D. MacNaughton, Northern Ohio Traction and Light Company, Akron.

These meetings were for the most part, well attended and it is to be expected that if they are repeated next year, even larger numbers of those interested in lighting problems will be reached. Arrangements have been made for very interesting meetings for all Association Lighting Men and other Association members to be held at Nela Park, Cleveland, by invitation of the Engineering Department, National Lamp Works of the General Electric Company. This is scheduled for July 14th and will include addresses by lighting engineers and a visit to the laboratories of the Engineering Department.

Besides these two principal features in the campaign, three articles have been provided for the Association Monthly: November—Fuel Conservation and Lighting Service; February—Prospects of Improving Industrial Lighting; March—Better Light for Industrial Plants.

Notes or communications from the committee have also appeared in most of the monthlies since the first of the year, and reports of the work of the committee have been given in the Electrical World, Electrical Review, Electrical Merchandising, and the N. E. L. A. Convention Daily. A paper which included an extended description of the work, was presented before a meeting of the Ohio Contractor-Dealers Association in Cincinnati, by Mr. L. T. Avery. An exhibit including copies of the policy and technical letters and material illustrating other phases of the work, was shown at the National Electric Light Association Convention in May.

Indeed, much interest in the efforts of the committee has been shown by the lighting interests throughout the country.

The committee has thus followed the usual custom in giving a description of the work of the year, but it feels that the most important part of the report is yet to be offered in the attempt to arouse further appreciation of the importance of taking up this campaign for better industrial lighting and pressing it forward The facts indicated at the beginning of this report indicate that now is the time for this work. During the past few years power, heating and other forms of load have absorbed the time of the central station man, largely to the exclusion of new plans for the lighting business. His work along these lines has accustomed him to the exercise of engineering knowledge and skill in the solution of the problems associated with these branches of the business.

In the meantime the science of lighting has progressed till it too calls for engineering knowledge, different though not more difficult than that required in the more familiar fields of electric application. It is this addition to his equipment of engineering knowledge which the Illumination Committee is seeking to supply through its various activities. This is a campaign too, in the carrying on of which the central station man need not stand alone, for it is also very much to the interest of the electrical contractor-dealer to promote good lighting.

It is generally only necessary to present the matter properly to him in order to get his cordial co-operation. But like the central station engineers the contractor-dealers must be educated, and it is for the central station engineers to start them in the right direction. One way in which this can be done effectively is by inducing them to subscribe to the "technical letters," described in the earlier part of this report.

On one point especial emphasis should be laid. This is not a campaign for ordinary intensities and methods of lighting. The industrial manager must be convinced that from the point of view of production and profits, lighting intensities far in excess of those which have hitherto been regarded as ample should be installed. With a knowledge of the subject and the data now being collected this can generally be accomplished with great advantage to all concerned.

The Illumination Committee, therefore wishes to urge again upon all member companies an active co-operation in this campaign for greatly increased industrial illumination and to ask all who have not already done so to appoint an active and energetic member of their sales-engineering force as their representative lighting man.

Last year, work was begun on a campaign for the popularization of an understanding of the elementary principles of good lighting through the schools. There is much need for this work and it had been expected to carry it forward this year, but the industrial lighting seemed more pressing, and the school work has had to wait.

The committee begs to make the following recommendations:

(1) That the committee appointed for the coming year complete the giving of the industral lighting correspondence courses to the present Association Lighting Men.

(2) That the effort to increase the number of these Lighting Men be continued and that on the completion of the present courses a second series be commenced for the benefit of those Lighting Men who are appointed hereafter.

(3) That the members of the Association exert themselves to extend the use of the "Technical Letters" course among contractor-dealers, architects and others.

(4) That the new committee consider the following activities:

(a) The extension of the work with the Lighting Men to other fields, as commercial lighting, schoolhouse lighting, etc.

(b) The work in the schools as mentioned above.

Respectfully submitted,

F. C. Caldwell, *Chairman.*
E. H. Biel,
G. S. Merrill,
Illumination Committee.

President Oppenheimer: Gentlemen, we must admit that this is a very interesting Report. I am sure that the Committee have spent time and effort in this work during the past year. It is also an acknowledged fact that the Ohio Electric Light Association leads in the promotion of industrial lighting which will enure ultimately to the benefit of both the source of supply and the consumer.

It is desired now to discuss this Report fully; yet our time is limited and perhaps we cannot go into details as deeply and as largely as we would like to; but we do want to hear from some of the men who have been so actively identifed with this illumination work. Among those men we have with us Mr. Merrill, and I am going to call upon him to make a few remarks.

Mr. G. S. Merrill, Cleveland, Ohio: I would greatly prefer, Mr. Chairman, to wait until I hear the discussion and see whether there are any special points that should be commented upon. The Report as it has been presented here represents the result of our efforts for the past year, and I am really anxious to see what the Association thinks of it. I would rather be called on a little later in case there are any points brought out in the discussion that I can reply to.

Secretary Gaskill: I want to say early in this discussion, that I do not know anything about illuminating engineering, as you know very well, not half as much as I ought to know; but I do want to say a little about the work of this Committee and to speak in very high terms of the really advanced work they are doing, and to call your attention to their recommendations which I feel satisfied the Executive Committee will carry out. Last year when the plans of the Illuminating Committee were presented to the Executive Committee we gave them an unlimited order to carry them out; because, as I stated yesterday, the Central Station men recognize that they are loaded with low price current and it is necessary to take some steps to increase the sale of the higher price current. Our costs are still in some cases mounting, and the Central Station man should remember that he is not only giving his customer better service but increasing his output in better price current by following the recommendations of the Committee. Now the Committee

have confined their work along educational lines this year and have very properly attempted to begin at home to train Central Station men—and the Lord knows we need training in that direction, because most of us do not know anything about illuminating engineering. We have been letting the contractor and the fixture man, and whoever else thought they knew something about it do the work for us. I am mighty glad that the Committee has plans in view to enlarge the scope of their work so as not only to cover the field of industrial lighting but also to cover commercial lighting; because you will recognize that outside of show-window lighting which has been probably kept up better because of the actual demands of the customer, illumination in the stores and the homes of this country has been done without any definite idea about illuminating engineering or the best way in which to secure the desired effects. I hope their work will get over into that field; and the same thing holds good with that as with industrial lighting, the Central Station man knows mighty little about it, and he ought to have the means of acquiring much greater knowledge on the subject. I think the Executive Committee is going to say to the Illumination Committee, just as they did last year, "You go ahead, and we will pay the bill." Certainly it is up to the Central Station men of the state to get busy and get back of this Committee and make their work a great success. I hear of this work from all over the country. They say: "We don't understand how a state Association can conduct a series of meetings of Committees as you do, and also conduct correspondence schools," and I have answered them by saying: "It is because we have the best Committees on earth, and because we have our best men in them who are willing to sacrifice for the good of the entire membership"; and when you have men that will do as this Committee has done, devote time and energy to the work, certainly we ought to rise up as one man and give them every support possible in our power.

This course in illuminating engineering that the Committee has been conducting over the country has gone away outside of the state, and is in fact the best course existing in the United States to-day and probably in the world. Certainly we are getting great honor from the work of the Committee and we ought to extend to them all the credit that they deserve. (Applause).

Mr. W. A. Wolls, Columbus, Ohio: There is nothing that I can say that will add to the credit that is due the Committee; their work speaks for itself amply. There is just one thing that has occurred to me by way of its application to Central Station operators. Mr. Gaskill commented on the fact that it is a very important question with the Central Station men to sell their high-priced current. As many of the schedules are made up for industrial lighting to-day, much of this current will be sold at the lowest price energy because the schedules are made up to embody that a certain per cent. of energy be purchased in connection with power. If the Central Station men must bear the expense of doing all of the illuminating engineering work it is going to be quite a burden, I fear, and it might be well to have the contractor and dealer who is paid for all of his work directly become more proficient in the illuminating engineering end, and let them use the Central Station representative as an expert in consultation. That is merely a practical application that occurs to me.

President Oppenheimer: We have not yet called upon another member of the Committee, Mr. Beil, for remarks. I do not see him. Is he in the audience?

Secretary Gaskill: He is in attendance on a Committee meeting.

President Oppenheimer: Is Mr. Naughton in? I think we might have a few words from Prof. Doane; the discussion would not be complete without hearing from him.

Mr. S. E. Doane, Cleveland, Ohio: Knowing what the Committee has stood for I cannot refrain from saying one thing that they could have said, and that is that if we are to bring the standard of lighting up to where our investigations indicate it should be brought, that we will sell three or four times as much current for lighting, not only industrial lighting which you have all mentioned, but also commercial lighting; that is the measure of our possibilities in this direction.

Your Illumination Committee has gone further than anybody else in this country or this world, I think, as your Secretary has said, in attempting to bridge the gap between the present lighting and the light-

ing that might be. We all know that lighting is the main reliance in Central Station business. It needs now the co-operation of the Central Station Managers to back up us illumination men in doing the kind of work that the Committee has made it possible for us to do. I have a good deal of sympathy with the attitude that Mr. Wolls has taken, or with the point that he brings out; I want to say that when we have presented this matter to the contractor and to his Association he has been just as eager as we could ask him to be to take the courses and do the things necessary for him to co-operate. It means business to him just as much as it means to you; it means business for every manufacturer. Of course the contractor feels that for every additional dollar's worth of current that the Central Station sells it means additional lamps and supplies and that he will get an added profit on a larger installation which will come with a higher grade of lighting and more intense lighting; so that he is interested in the thing mightily. It is one of the few cases, gentlemen, where everybody wins. It is not often that you have a proposition submitted to you where every contributing element, the contractor, the Central Station man, the manufacturer and the customer, all win; and indeed, the customer wins most of all. I would like to concur in all the laudatory things that your Secretary has said of this Committee; they have done some magnificent work; I think the thing that now remains is for the Central Station men to hold up the Committee's hands and back up the illumination man in his own organization in carrying on this work. (Applause).

President Oppenheimer Gentlemen, those of you who were here last night and listened to the lecture by Mr. Durgin, I am sure were greatly interested in what he had to say. I do not know whether he told us all he knew last night, or not, he may have something in reserve that he can tell us this morning that will be of some benefit to the Committee and to the Association at large. I would like to hear from Mr. Durgin.

Mr. Wm. A. Durgin, Chicago, Ill.: Mr. President and Gentlemen, the point which particularly arouses my interest is the suggestion that the development of lighting and the making of industrial lay-outs is going to be pretty expensive for the Central Station. That has not been our experience. I believe that the education of your men along any line

will increase their general value quite sufficiently to compensate you for the expense of that education. The making of lighting lay-outs in themselves is a very small matter after all. This illuminating engineering subject is pretty simple when you once get into it. The time taken for an ordinary lay-out is only an hour or so; and the intimate contact that the salesman gets with the customer in getting ready that lay-out and in making it I believe you will find will very much more than compensate you in the improvement in your general business relations. (Applause).

President Oppenheimer: Gentlemen, we are honored to-day also with the presence of a man who is nationally known in the electric lighting field in the development of electric lighting. I would like to call upon him for a few remarks—Mr. George Stickney, Illuminating Engineer of the Edison Lamp Works and Past President of the Illuminating Society. I know you will be glad to hear him and know him. Mr. Stickney, will you kindly approach the front? (Applause).

REMARKS OF MR. GEORGE H. STICKNEY, HARRISON, N. J. PAST PRESIDENT ILLUMINATING SOCIETY

Mr. President, I thank you for your kind words. It is a pleasure to me always to come to the Ohio Electric Light Association meetings. I have not been here for a number of years; but I used to come here quite a number of years ago and have always enjoyed it both here and at Put-in-Bay. I am mighty glad to see you taking up actively and in a leading way this problem of industrial illumination and the more intensive sale of industrial illumination. I have had occasion over quite a period of years to study lighting applications, and from that observation which I think has been unprejudiced, it has been very clear to me and to all of those with whom I have discussed the question, that industrial lighting is the most undersold part of the electrical business.

Now you gentlemen are in the electrical business as a natural monopoly; and when you want to keep other people off the field you incur an obligation to give the very best service that you possibly can. It is good business to give that service in itself. We know Mr. Durgin knows as the representative of the probably one Central Station that has taken up the lighting question in a more intelligent and more forceful way than

any other that they have studied it and found it good business. But beyond that, you have an obligation.

Now it has been my sad observation that Central Stations furnish poorer industrial lighting lay-outs than industrial plants as a whole, not in any particular case, but as a whole I have had occasion a number of times to gather and study data on lighting installations by central stations in order to put it before Central Station men; and in getting those figures together that has been too evident. I do not think you can realize what that means, you do not get out and see it. One of our troubles is that when we tell the truth in this matter to you it sounds almost like a fairy tale, like the story of Alladin's Lamp. The manufacturers, as you know, are spending thousands of dollars in trying to get one or two more percentage of energy out of a transformer, or generator, or motor. We have advanced through lamp development several hundrd per cent. Mr. Durgin's talk last night pointed out where by selection of lamps and equipment and by the proper arrangement of equipment you can get probably several hundred per cent. more than is being done to-day with the very materials that are in your hands. The lamp manufacturers and the illuminating engineers are the people that have brought you this data, many of them have to handle facts in a wholesale way. You are in touch with the local situation; it has to be applied practically in local situations, has it not? It has to be done in your respective towns and communities, it cannot be done in the country except by general propaganda; but the actual construction will be done in your own towns. Somebody has got to bring together these various elements; the contractors have got to do their share, we cannot do it all. I do not think you have to undertake all of the expenses; but you can do what some of the other fellows have done to push this movement along. You can in your towns go out and bring together the people that are also interested in the lighting business, get them to see where this great game, for the customer, for the lamp manufacturer, for the fixture dealer, for the contractor, can be made not only an individual gain but that of the whole country. As Mr. Durgin said last night, this whole country should stand shoulder to shoulder in the great competition of all the world. You are going to make factory work safer, you are going to make the workman's condition better, you are going to help the workmen to earn more money, you are going to solve some of

the problems that must always hinge on greater and better illumination. It is a sociological as well as a commercial matter.

I do not think the illuminating engineers are going to stop here by a good deal. We have just elected Mr. Doane as President of the Illuminating Engineering Society; and the more ammunition we put into your hands the more of you we want to help fire it. I think one reason that you have not been able to appreciate some of these things is the difficulty of measurement, because you have not been able to conceive of some of the light quantities. This foot candle meter is going to be a useful factor, and with just a little familiarity is going to be very valuable. They make fun of me for using technical terms; you talk in just as technical terms when you talk about candle power. When candle power is used in two entirely different senses it is often confusing. Now the thing that tells the story is the foot candle and the illuminant; those are the quantities, gentlemen, that tell what illumination means; those are the quantity elements. There is still another element—glare; and then there are a large number that you cannot quite easily define or measure which common sense will tell you you have to take into calculation; but the thing I wanted to get to you is, that as a condition major to any real advance the Central Station man must individually get out and do something; that you do not go away from here and say that you have heard interesting papers, good talks, and all that, and then forget all about it, but that you actually apply the thing; and I think that Ohio has shown leadership in this matter that the rest of the country will have to follow. If you will get out and apply it yourselves it will cause other people to do likewise, and then we will all get the full benefits that you and the people and all of us want. I thank you. (Applause).

President Oppenheimer: Gentlemen, we are certainly pleased with the talk that Prof. Stickney has given us. I am sorry that our time is so limited and that the moments are passing so hastily that we will have to drop our discussion at this point; but before concluding it I want to ask Prof. Caldwell to make a statement with reference to the paper submitted on foot candle question.

Prof. F. C. Caldwell, Columbus, Ohio: You will recall that in the Report as one of the activities of the past year we mentioned that we

instituted a contest in connection with the problem work of the technical letters. The lighting men of the Association were invited to compete on the foot candle matter, and the Engineering Department of the National Lamp Works of the General Electric Company offered to the man who should send in the best set of answers to the problems contained in the first six technical letters a prize. As the result of that contest I have pleasure in announcing that the victor is Mr. Ahlborn of Zanesville, who handed in a remarkably good set of answers, the average grade on a careful grading being over ninety-five per cent. Honorable Mention should also be accorded to Mr. Ward, of Columbus, and Mr. Purdy, of Springfield, both of whom sent in a remarkably good set of solutions to the problems. (Applause).

President Oppenheimer: Gentlemen, next in order will be an address which has been scheduled for this morning's meeting—a man whom I believe many of you have met, a man who probably has heard a great many of our troubles perhaps in his capacity as adviser to the Public Utility Commission; a man whom I have personally met and have personally been in conference with, and whom I have found to be a man of broad and deep thought, of a liberal mind, with a keen sense of justice and equity for the interest of individuals as well as the state. I have the pleasure of introducing to you Honorable Freeman T. Eagleson, formerly Attorney for the Public Utilities Commission of Ohio. (Applause).

Mr. Eagleson addressed the convention as follows:

RELATION OF UTILITY COMPANIES TO PUBLIC SERVICE COMMISSIONS

Freeman T. Eagleson Columbus, Ohio.

Mr. President and Members of the Association:

I am very glad to have this privilege for the first time of attending this splendid Association and to see at first hand some of the plans which are formulated by you for the purpose of going into different sections of the state there to serve the public.

I claim no special qualification to appear before you in the discussion of the topic assigned to me, which is in substance the relation or the attitude of the public authority to the public utility. Literally

translated that means the attitude of the public to the public utility, because in this representative government of ours where the public either in conventions or at direct primaries select their representatives, these representatives depending upon the public for the sentiment that means success in their campaigns, it is but human nature that they reflect public sentiment in their attitude to the public utility when acting in an official capacity.

I hardly know why your Secretary was kind enough to invite me to attempt this address, unless it was because he knew that I had spent four years as counsel for the Railroad and Public Utility Commission of the state of Ohio, and that since I left that Commission I have been trying to work almost exclusively in public utility law.

I am going to try to say a few things this morning to you men who are fresh from the Central Station and the office of the Manager, you men who come directly in contact with the public, that may cause you to think more—not that you have not been thinking, because you must do that both from choice and necessity—with reference to the public's thought in their relation to their servant the public utility.

There is no one public utility that has the future that the electric light and power people have. Take for comparison the natural gas industry that has passed its zenith and is rapidly on the decline, no intelligent unbiased witness but what will agree that we are nearing the end of the natural gas service of any considerable amount. That means, men, that the electric current is the logical and the undisputed successor of the natural gas supply. Natural gas has come, and is going rapidly, and the public has failed and is still failing to realize the value of natural gas.

Artifical gas cannot compete with you men. Its inherent value is about one-third that of natural gas; it costs about three times as much to make and distribute it as it does to make artificial gas. So the doors of opportunity are opening to the electrical men.

You have thrown down a challenge to nature in the things that the electric service has been doing. Electricity is robbing earth of her night and making those hours which nature intended for repose hours of usefulness, thus lengthening our lives. In this mighty Twentieth Century, this greatest of all periods of time in which to live, human energy, human commercialism and human advancement does not cease during the twenty-four hours of the day. It is a marvelous thing to

conceive that instead of transporting heavy bulky coal from the coal fields into the different municipalities over the country that the electric light people have proposed the idea of establishing generating plants at the coal fields and transmitting not the coal but the power. They are going to take the great potentiality that was placed there by nature and transport it for hundreds and thousands of miles in the shape of electricity into the factories, into the shops, into the homes, and into the marts of trade; it seems like fiction, but it is no less the truth.

Now what is to be the attitude of the public to all servants of the public? No sane man challenges the merit of the commodity which you make. If I understand it correctly, there is no limit to the sources of supply of electricity. It is as abundant as the winds and the atmosphere. A tremendously striking statement was made here a while go. that because of war-time prices the public utility company, fastened under fixed rates—a t erribly unscientific thing—has been placed in a dilemma, because the cost of production is mounting with incalculable haste and yet its income, fastened down by these rates that have been fixed by the municipal councils, or by the public utility commissions, or by the courts, is offered no relief. How did you men solve that? You solved it in part, not in total, by going out and getting new business under the conditions as they exist, conditions which public councils were helpless to change with reference to industrial rates at least. But the man whose supply was limited could not secure even that partial relief because of his inability to meet the increased demand even if he created it. It was only possible with those who were fortunate enough to find a way to increase their facilities or avail themselves of new sources of supply, to thus partially meet the situation.

I kno w personally that you have had a hard time. It is unfortunate that the public authority is not holding up your hands, because the rate making conditions are not sufficiently flexible to meet the changed economic conditions. I have tried to represent both electric and gas men and have plead before public councils the cause of the public utilities during this war period, and have earnestly urged them to raise the maximum fixed rates that were honestly and justly made away back in 1912, 1913 and 1914, when you could buy something with your money, but which rates during the last three or four years have been wholly inadequate. The reply that was given me has almost uni-

versally been, "A contract is a contract." Such an attitude defeats the very purpose of the contract; as Professor Caldwell says, "It is a game in which the people win"—and it is. And there is just one solution as I see it, and that is public education, for the reason that the public control the councils, and public utility commissions over the country are appointed by political executives elected by political parties and depend for their offices upon public sentiment and the votes of their constituents.

The public utilities in the days and decades past were rather deaf to public sentiment. That day is past. That condition brought into existence the regulatory bodies both in the state and the nation, and now the public tells the public utilities what they may do under their regulated powers; and I think the public utilities should welcome the day, provided the public utility is willing to go to the mat—if I may use the common tongue—and accept proper regulation rather than be subject to the uncertainties of the average municipal council. The public utility commissions themselves have supposed experts who are appointed because th ey are believed to possess special qualifications and are dispassionate judges of fact, although it may be perchance that they have been appointed by a great public service commission of a sovereign state without one atom of experience in reference to public utilities and the rate making processes which are so vital.

How can we as public utility men secure a reasonable return on the investment made in property used and useful in the service of the public from that man who gets his position because of his political activities—I am just stating the facts and the truth, not by way of reflection upon any particular commission? The only way to get that man right on the subject is to educate him, because he comes to his job uneducated and, in the majority of cases, with the dominating motive or impelling force in his system that of prejudice rather than an intense desire to see that the public utility gets justice; and he does not reason far enough or go deeply enough into the subject to understand that unless he gives to the public utility a rate that will enable it to furnish one hundred per cent. efficiency and equipment, to that extent does business make its servant a poor excuse that is merely in the way of progress, thus defeating the very purpose of the public utility which is to render to the community which it serves

that character and kind of service which alone can make it of real value and use to the community.

Why, it has been painful to me to witness during the last three or four years the struggle that the public utilities of this country have been making in order merely to exist; and yet how long could we live in peace, comfort and happiness, if the public utilities of this country were to cease to function? Yet they have gone through this war condition under fastened rates, crippled in every respect. Take the interurban systems of the state, many of them run by electric light plants, I can name men here who could tell you of the heartaches and the sleepless nights they have been through.

War-time conditions have inflated the value of money. The companies could not buy anything with the measly rates they got under the normal conditions preceding the war; yet they were fastened, while the Charley Chaplins and a lot of like enterprises on the outside were making war-time money by the barrel—enterprises that if they were wiped off the face of the earth would not materially affect the sum total of our prosperity or happiness, and mankind would go on just the same. Truly our economic system with reference to the things that are really worth while has been chaotic. I have been preaching a doctrine analogous to this all through this war period. I know that public utilities, I know that electric lighting plants, have not been able to raise the necessary money for betterments because of that rastened rate condition. Many of them had not the security nor the stability to finance themselves sufficiently to make necessary improvements, additions and betterments so as to be prepared to invite new industries into their respective communities with a guarantee that service will be given them when they come. And that is the condition that has been existing all over this country of ours and was bound to exist under those fastened rates.

So I believe there is just one solution for it all, that is to go to the commissions and go to the councils and give them the proper information on this subject. A thousand times I have appeared before this or that average municipal council composed of men elected from boards or precincts, when the ordinance of a company had expired or was just about to expire. An electric light ordinance is submitted, or they decide that they will frame a new ordinance oftentimes without even a previous conference with the company and without the

slightest intelligence on the subject. They look over the situation and say, "Well, we will fix the rate at so and so," and then they pass that ordinance just in a make-shift sort of form. Probably the rate they have named is two hundred per cent. below the cost of operation. They do not know. They do know that the public in their respective wards or precincts does not want to pay any more than they have to pay. I appeared before a council not long ago for a gas company. One member of the council got up and said that the company wanted an increase in the rate; and then another member of the council said he did not feel at liberty to vote for an increase in rate because he had asked several people in the city whether they wanted an increase in rate, and they said, without exception, "No." (Laughter). And that is the way they vote in council, that is the way the average councilman acts. But that man voted "Yes" before I finished with him on the company's proposition to increase the rate. I asked him if he did not think that any man on the street if he were asked if he wanted to pay two dollars more for shoes would not reply that he did not want to do it; but if he found that he could not get the shoes for the lesser price because of the changed economic conditions entering into the production of the shoes, he would pay the advance.

I have faith in the great public, men; I do not want to be understood as being a pessimist, I have faith in the public, but my faith is predicated upon the eternal education of the public. I know a city in this state that I cannot afford to name very well that is standing in its own light both as regards electric light rates and gas rates because an ill-informed council so far as intellect is concerned, actuated by prejudice, and the fact that an election is approaching for members of council. That city because of its industrial activities ought to have a great future growth, but it is at a practical standstill. Now who is the loser in that sort of a game? Why, both parties. They are stifling their public utilities and shutting out their whole community from the great race for success that is participated in by the municipalities all over the country.

The public utilities cannot make the fabulous profits that they formerly did. There was a day when the public utilities companies fixed their own rates. They cannot do anything like that now, because of the existing commissions. We have had two or three decisions that are golden rules, so to speak, with reference to public utilities. That

started in 1876, when the Supreme Court of the United States enunciated this doctrine in the case of Mohn *vs.* Illinois. The Supreme Court of the United States said: "When one devotes his property to a use in which the public has an interest he in effect grants the public an interest in that use and must submit to be controlled by the public for the common good"—note the words "common good"—"to the extent of the interest that is thus created. He may change his grant by discontinuing the use, but so long as he maintains the use he must submit to the control." That is the Opinion of the Supreme Court of the United States of America.

Now they followed that in what is known as the great case of Smith *vs.* Ames: "A corporation may not be required to use its property for the benefit of the public without receiving just compensation for services rendered by it. How such compensation may be ascertained and what are the necessary elements in such inquiry will always be an embarrassing question." Those of us who have studied the rate making cases must also most keenly appreciate the difficulty of scientifically fixing a rate under the laws as they now exist. The Court says further: "We hold, however, that the basis of all calculation as to the reasonableness of the rates to be charged by a corporation maintaining a highway under legislative sanction must be the fair value of the property used by it for the convenience of the public; so that the duty toward the public authority is such that when we submit our property to the public service then we must also submit that the public has a right to tell us what our rates shall be." Then that great tribunal follows that by saying that the public must not take your property thus submitted "without due process of law"; in other words, they cannot make you serve the public without giving you a reasonable return on your investment; and there is a line of authorities without exception holding to that principle. Justice Hughes in the great Minnesota Rate Case laid down a proposition that is worthy of careful study. His greatest Opinion on rate making was in the Minnesota Rate Case where speaking for that great tribunal, he says: "The United States Supreme Court does not sit as a board of Review to substitute its judgment for that of a legislature or a commission, a lawfully constituted body, as to matters within the province of either."

That is to say, men, that when your councils and your public utility

commissions have in accordance with the statute valued your property used and useful and fixed the rate, unless they have made a legal mistake in the procedure the Courts will not substitute their judgment on questions of fact for the judgment of supposed trained commissioners and the experts assisting the nominal commissioners.

So that brings us right up to the threshold of this proposition: our hope, our function and our duty is to educate the commissioner who is uneducated in the highly technical art of making and finally declaring the "just and reasonable rate" that the public utility should receive on the property used and useful by the public. I am, as you will see, confining myself more to a discussion of the attitude of the public than the attitude of the public authority, because they are synonymous, particularly so in this day and age.

It is a grand thing, it did my soul good, men, when I heard some one here say—I do not recall who it was—that when you go back to your Central Stations to-morrow, after you have been to this great convention and listened to the things you have here in the past few days, you will be again taking up a practically lonely and solitary struggle for efficiency; you will have passed out of the enthusiasm and the social pleasures of this convention and will find yourselves at home at your own sub-stations striving to make something, to bring something to pass so that the world shall be the better because you have lived. That is the individual side of the question, and I tell you, it is individualism that the world needs.

I have lived long enough to have developed a philosophy of life as I have gathered it from the history of the world, both sacred and profane, and as set forth by tribunals everywhere over the face of the earth, which teaches that the nation and the community that has made its impress upon conditions as they exist is that nation and that community where individualism is permitted to exercise an unimpeded sway. Collectivism, like epicurianism in religion, never gave the world the best products of the human brain. I am not willing to go quite so far, but will go almost as far as Herbert Spencer in his great doctrine that individuality alone is the secret of great achievement. In collectivism you stifle the initiative and the enterprise of the individual. If you want a difficult problem solved, if you want something wrought that is worth while let the individual become dedicated to the solution

of the problem and he will work on it in daylight and dream over it at night, whether it be a problem in engineering, or a problem in electric or industrial lighting, this wonderfully interesting subject that you have so developed within the last year or two.

There is nothing more vital to human life than that the solution of all these things be left to the free play of the individual who will dedicate every atom of moral and intellectual energy to the solution of his task. When I hear a man talkng about the great philanthropic collectivism of the people generally, it strikes me as a dissipation of the fruition of individual labor rather than the creation of anything that makes for the advancement of the human family. The philosophy of collectivism deals with conclusions and not with premises. So I say to you again, men, that as the rain-drops falling from the mountain tops make the streams, the rivers and the ocean on which the argosies of commerce float, so it is the first duty of very individual to try to render one hundred per cent. efficiency to the service all over this country, and the result of all the labors of individuals welded together is what makes the United States the nation of the world that sits on a hill and sheds its rays of light and inspiration to the dark places of the earth. That is what has made us what we are; that is what has put our public utilities where they are and where they have been for the years past—individualism.

I am unalterably opposed to Government ownership. I am just as much in favor of public regulation of public utilities; but ownership and regulation are just as widely opposed as the negative and positive pole. We have no place in this country as I see it, if we are to stick to the concepts of our original Constitution, those things that have brought us to the point where we are, we have no place in this country for anything else than individual enterprise and individual industry. That is the mark set by our public utilities; that is where we are going to get. And when we get there—and if we are not already there, time and experience will force if they do not lead us there—we will keep in the very closest touch with the public.

The public at heart is honest. We are all of the public; we are all human and subject to the limitations of the human; we are chock full of passion and prejudice, and that passion and prejudice are often such that we may lose sight of judgment and reason. We do so many

things that we ought not to do, and the public on the spur of the moment are against a raise in rates. The very term "corporation" has been associated with sometimes absolutely dishonest methods, so that the public have grown to be prejudiced and the name has become objectionable to them, so that as to it they would like the old Grecian philosopher write on their shell the word "Banished"; and when they have been asked, "What have you got against corporations, they are your best friends?" they answer, "We are tired of the name."

There is just one way to remedy this condition of affairs, and that is to go yourself to the public and tell them the truth, and the public will listen to the truth. I do not mean the occasional demagogue who needs putting out of the way rather than education, but I mean the rank and file of the public who are honest at heart and who seek to get right and do right.

I want to refer to one more matter. I have discussed this with our Public Utility Commission in Ohio and our Tax Commission in Ohio, the question of how we are going to get along together in the future with our fixed rates on one side and our rapidly mounting costs on the other side. The Taxation Commission are raising the tax values of utilities, looking to the public utilities as the chief source of revenue for the state, putting us in between the sandwich; and then the public authorities are saying they cannot raise the rates. What is to be the end of it all? Why, gentlemen, if that course is persisted in they will wreck their public utilities, there is no other conclusion for that sort of thing. It is just absurd when we come to think of a rate that was fixed in 1912-1913-1914, when the purchase power of the dollar was twice what it is to-day—it is absurd when you think you have not only to accept that same rate and with that same dollar attempt to go into commerce and in trade and buy with it a commodity that is twice as high in price as it was then. If that rate was within the realm of reason when it was fixed, it is the extreme limit of absurdity at the present time.

The man who is thinking of the great to-morrow in our civilization knows that it is the public utility that is responsible for the success of our industrial life and our social happiness; and I say again, I think the solution of the difficulty lies in the education of the public—but it is nearly noon, it is warm in here and I expect most of you want

to go in bathing before you reassemble this afternoon. (A Voice: "Give us some more"! Let me say, however, that you do not want to miss that lecture this afternoon. I do not know whether it is my place to mention it or not, but that lecture will give you the philosophy of individualism versus collectivism. If I understand his theme, he is going to give us something that no man who is consecrated to his duty in this day and age both with reference to the obligation of good citizenship and patriotism, no matter what his trade or vocation, can afford to miss this afternoon.

Now I have expressed myself in some cases very badly because I have spoken almost without preparation; but I am deeply interested in this question.

Let me say, too, that the public utilities have been hard hit during this war time, and they have exercised a patriotism that has been surpassed nowhere in the world; and they have done it knowing that in so doing they were heading to bankruptcy. They have done it knowing that with the rates that were fastened upon them before the war they could not retire their maturing bonds. Nevertheless they have stood by the flag, and consecrated to duty they have come through the trying war, and now are going to the public to ask the public if they want their own public servants to be strong and alert, with "Forward!" as their watchword, to give them the facilities with which to build up the very community that constitutes the public.

And now let me conclude with a little story, because I have felt a little note of pessimism running through this and because I know that if conditions have seemed to be against us it was only because the prejudice of the demagogue whose efforts are always against the true interests of the people, although he claims to represent them. He is a liar, he is a selfish hellion, he is not a good citizen of this or any other government. No man should be afraid to stand before the public and tell the public the truth. If he does anything else he is not serving the public. But my thought is that it is not true that the public in this country will not give you justice when you present your case properly before them. The public utility is not a private enterprise, it is a public concern, a public servant, and the public ought to be, if they know what is good for them, just as much interested in the success of their public utility as in that of any other industry in their

community. The investors in public utilities cannot make a big profit, because their rates are regulated by law. They can only get a reasonable return of six, seven, or eight per cent. on the investment. No public utility is a gold mine, or a silver mine. It cannot be exploited. That day is past and the owners of public utilities know it. But the public does not seem yet to know that, and I believe that when they do know it they will come to our support and permit us to go forward and be proud of their public utilities.

The little story that I will tell you will illustrate how we get back what we give forth. Louis Agassiz, the great naturalist, was blessed with a wonderful little mother who taught little Louis those precepts that as he grew up developed in him and made him the world's greatest naturalist. I expect that all of us who have made any success in life may well attribute it to the teaching, the precepts and conduct and the love of a mother. Louis Agassiz was raised by that kind of a mother. She used to take him out into the Alps and let him listen to the echoes, and one of her favorite places to go was the Echo Glen of the Swiss Alps, where the sound is repeated back in ever increasing echoes, just like the notes from a great pipe organ. Louis' mother took him up there one afternoon to illustrate to him something which I think she succeeded in doing. She asked little Louis, then a mere tot at her knee, to call out something. Louis called out, "Who are you?" And back from a hundred different pipe organ tubes of the crags and the mountain came the answer: "Who are you?" And that sort of nettled Louis, and Louis went back at it by saying, "I don't like you!" And the same answering and ever multiplying voices came back a hundredfold, "I don't like you!" And little Louis, with his sensitive nature, because geniuses are always sensitive, burst out crying and for the time refused to be comforted; but his mother pressed his little sobbing face to hers and after a time whispered: "Louis, don't you remember what we read last night in the Epistle of the good St. James, that 'as you give so shall you receive?' Try again, Louis, and remember that as you speak so you will be spoken unto." And little Louis raised his voice and said, "I would like to know you!" And back came the answer, "I would like to know you!" And little Louis in the estasy of his youthful heart there learned the lesson that passion and prejudice attract to themselves their like; and he again

shouted out in the childish voice that penetrated the remotest nooks of Echo Glen, "I love you!" And back came the echo a thousandfold, "I love you!" And, oh men, an analogy may here be drawn, illustrating the fundamental truth of your relationship to all society, that as you give in sincerity and truth, so shall you receive.

I thank you. (Applause).

Secretary Gaskill: Mr. President, I know I speak the mind of every man here when I say that our hearts go out in thankfulness to this splendid man for his scholarly address to us this morning. I only hope that we may be able next year to get him to give us again a message, because Mr. Eagleson always gives us a message. Those of us who had frequent conferences with him when we held the position of adviser to the State Public Utility Commission found him always fair, always honest, and always right, and he has done so much for you men that I know that this expression of applause that you gave him at the conclusion came from the heart of every one of you. We will take care of Mr. Eagleson in the general vote of thanks that will be passed at the close of the convention.

I want to re-echo what he said about being here this afternoon to hear the greatest talk that you ever listened to in the last year or two upon the question of that great menace that is hovering over our country of socialism. You will be talked to by an expert who knows more about their ramifications than any other man in the United States. He has just come from the city of Winnipeg where he has been staying long enough to have seen a great many things that nearly destroyed that beautiful city.

The Secreary then made some routine announcements, after which an adjournment was taken until 2:30 P. M., of this date, July 17, 1919.

SEVENTH SESSION, THURSDAY AFTERNOON, JULY 17.

The convention met pursuant to recess, the President, Mr. I. L. Oppenheimer, in the Chair.

President Oppenheimer: The convention will please come to order. Ladies and Gentlemen, I am pleased to have the privilege of addressing quite a few ladies this afternoon; we are certainly glad to have them with us, because we believe that the subject that will be discussed this afternoon will be of some interest to the ladies with household responsibilities as well as to the men who are present.

There will be but one matter to be taken up this afternoon, the address upon the subject that is of most vital interest to your respective communities but to our state and our nation, and in fact, it covers the entire world; it is not confined to our special industry but affects every industry in existence in everything in which labor is a factor.

We are extremely fortunate in having with us a man that will discuss this subject in a most thorough manner. I have asked a few of our members whether or not after this address they thought they would like to have some discussion on the matter and whether they might desire to ask the speaker any questions. They told me that after he got through there would be no questions to ask, he would answer everything in his address.

Ladies and Gentlemen, I have the pleasure of introducing to you Mr. F. G. R. Gordon, of New York. (Applause).

THE TREND OF SOCIALISM

ADDRESS BY F. G. R. GORDON, NEW YORK CITY.

Mr. Chairman and Friends:

The calamity howlers are always with us, one of them is born every minute; and along with the birth of the calamity howler has always been a sucker. Both of them live far beyond their allotted time of life. Ever since the human family came into this world we have also been

afflicted with the medicine men, and they will continue to exert an influence on civilization until the end of time. One of the most embarrassing of these medicine men that we have ever had in all the ages that are past is this world-wide movement which in Russia they call Bolshevism, but which the rest of Eurpoe designate as social democracy, and in America they call plain socialism.

It is not a movement that you can afford to ignore, that you can afford to sit down and watch and wait to see what it is going to do; because that movement, world-wide in character, and everywhere seeking the same goal, is rasing and expending in this country more than five million dollars a year and is employing five thousand people for the purpose of overthrowing and destroying every social institution that you and I hold dear. The socialistic party in this country is raising and expending one million dollars a year in the Northwest where they have 300,000 members of the Non-partisan League, which is organized and led by socialists for the express purpose of bamboozling the farmers into the socialist camp.

Besides all this we have what I call the half-baked socialists of this country led by such men as William Randolph Hearst, the chief demagogue of this country, Mr. Senator LaFollette of Wisconsin, and Mr. Henry Ford of Michigan. Those three men are doing more to create dissension and discontent in this country than any other forces that we have to do with. Mr. Hearst recently caused to be published in his widely-circulated press reaching from the Atlantic to the Pacific an editorial which stated that before the war the German Empire derived one-half of all the expenses of carrying on that great movement through its profits upon the ownership and operation of 37,000 miles of railway. This plausible editorial writer went on to say that if the Germans could secure $750,000,000 in profits from the operation of their railway systems. what could not the American people do with their 270,000 miles of railway? Were not the American people as smart as the Germans?

Now the only serious thing about that editorial was the fact that there was not a word of truth in it—not a word. The German Empire never owned this railway system in the world; the German Empire never owned any railroads at all except a little dinky line down in Alsace Lorainne which they captured from France in the Franco-German

War of 1871, and on which they never managed to make both ends meet. Consequently, the German government as a national organization never received a single penny from the government ownership and operation of its railway system. The railway system of Germany is owned by the Germanic States, and always has been, either jointly or together, just as the states of Ohio and Indiana might jointly own the Big Four system, for instance, or the state of Iowa could own its Hocking Valley system, for instance, or as the state of Hesse owns the great Hesse Railroad system, the most important one in Germany.

If Mr. Hearst's socialistic editor really wanted to inform the American public more about the railway systems of Germany he would have told you that the wages paid upon those socialistic lines in 1914 were $408.00 per year as against $810.00 per year for our railroad people here in America. He would have also said that the cost of transporting a ton of freight, for instance, one mile on those German railroads cost the people there $1.37 as against only 72 cents in this country. It cost the German people in one year $526,000,000 for freight bills, whereas if they had enjoyed the cheap freight rates which prevailed in this country they would have saved $214,000,000. If, on the other hand, the American people had been forced to pay the German rate for transportation of their freight for the year 1914 it would have cost us $5,000,000 a year more than it did cost us. These are the facts about the German Railway system which Mr. Hearst and his socialistic editors did not tell you. You have there a fine illustration of the utter foolishness of a great government attempting to carry on the railway business of the country. Mark you this! What is everybody's business is nobody's business, and therefore government business is always neglected, it is always run in an inefficient and uneconomical method, it is not carried on in the interest of the people, with efficiency, or furnishing good service.

We can no more expect this government or any other government to conduct the affairs of a great business concern with economy or efficiency than we could expect a bow-legged girl to get married in the town in which she was born.

Canada in the year 1914 had a national debt of $544,000,000. $441,000,000 out of that great sum represented Canada's plunge into state socialism. The people of the Dominion of Canada paid $14,000,000

a year interest upon that great sum, a per capita debt of $72.10 as against $10.00 in this country. Yet their debt was more than seven times as large as our debt. For fifty years the Dominion of Canada has owned and operated the Inter-colonial Railway system and the Prince Edward Inland system jointly, a system of 1741 miles of railway. I speak of Canada because it offers a fine illustration from the fact that you have there the same class of people living under the same laws and producing the same kind of crops, taking their coal and iron from the same kind of mines. They have three great railway systems, the Canadian Pacific, the Grand Trunk, owned and operated under private ownership, and the Inter-colonial under government ownership and operation. The first two of these, private lines, have given splendid service. They have paid some millions of dollars in taxes every year to help support the government, and they have paid dividends to the men who own those railroads. The Dominion of Canada has some $381,000,000 invested in its Inter-colonial Railway and the Prince Edward Island lines. The late James J. Hill, the master railway builder of the world, himself a native of Canada, and who new more about railroads than any other man that ever lived, said that the Inter-colonial Railway ought to have been the best paying piece of property in all Canada, whereas it is the worst, and has never paid anything, notwithstanding all the money which has been put in to build and equip the road. In losses and interest upon losses the Dominion of Canada has lost net the sum of $268,000,000 on the operation of the Inter-colonial Railway, a line that ought to be the best paying line in all Canada, because it stretches for more than a thousand miles from the great city of Montreal down to the maritime provinces on the Atlantic seaboard. It has an absolute monopoly on the great coal and iron mines of Nova Scotia and the great iron and steel plant of Sidney, and the production of all these mines and of this great iron and steel industry cannot reach the markets of the world except by passing over the Inter-colonial Railway. For that reason it ought to be the best paying line in all Canada. I was passing over that line one day and in the seat in front of me was a Nova Scotia farmer. I soon engaged him in conversation. I said, "What is the matter with this railway, why doesn't it pay? It ought to be the best paying piece of property in Canada." He said to me, "Did you see that

conductor who came through just now?" I said, "Yes, he is a nice-looking fellow, I have been riding with him all day, he is a fine chap." The farmer said, "Yes, he looks all right, but that chap is a politician. The fellow running the engine is another politician. The man who is working on the track is a third one, they are all politicians. The trouble with this railroad is that they think more about getting the vote out on election day than they do of getting their trains in on time. That is the whole trouble." And that is the whole trouble. But Canada does not seem to be satisfied with the experience it had. In 1903 the Canadian Parliament decided to build the National Trans-continental Raliroad, a distance of 1,800 miles. The Minister of Finance sad that it would cost $34,415,000. In 1912 the Dominion government created a second commission. They had created a commission in the first place and had given them a free hand as to expenditures; but after nine years they created a second commission for the purpose of investigating as to what the first commission had done. Just before the war broke out this second commission made its report showing that there had been expended $173,000,000 and the road was not anywhere near completed. They estimated that it would cost $200,000,000 to complete the road—$200,000,000 instead of $34,415,000 as first estimated. I suppose that when Canada gets through with some of its war problems they will create a third commission and set them to work for the purpose of determining and making a report on what the other two commissions have been up to.

Italy offers another fine illustration. Up to 1905 the railway systems of Italy were under private ownership and they were paying large sums of money in the form of taxation and also dividends to their owners, while they gave splendid service to the people. In 1905 the Italian government socialized 8,361 miles of railroad, and within six years they had added 50,158 men to the staff of that railroad, without building a single additional line of road. Who do you suppose paid the salaries and the wages for that large number of people that were added to that railway's payroll? Why, every man, woman and child that lived within the country of Italy. For the six years preceding the breaking out of this great war which is now coming to an end, the Italian government lost over $35,000,000 to $42,000,000 in an attempt to run that great business enterprise. Before the war bus-

iness organizations were holding meetings from one end of that railway line to the other, protesting against the miserable service that they were receiving, and as a result of that the transportation department decided to change the superintendent of transportation from the Milan district to the district of Rome, which was suffering more than any other division of that railway system. So they informed the superintendent of the fact. He owned his own home in Milan. He sold it preparatory to moving to Rome. Then delegates representing the railway workers' union of Italy appeared before the Minister of Transportation and informed him that they were well satisfied with the easy kind of a life that they had been leading in Rome and that they would not work under any other boss; that if the attempt were made to withdraw him they would tie up the line from end to end and there would not a single wheel turn if that change were attempted to be made. So the government abjectly surrendered, as they always have surrendered in any kind of a democracy. When a railroad is owned and operated by a government anywhere upon the face of this globe it cannot have efficiency. The only place in the world where they have efficiency and economy under such circumstances is in the case of the Japanese Railway system, where the wages average $115.60 a year, and where nobody has any liberty at all. Why, if the Japanese railway workers attempted to go on strike their leaders would be sent to prison for life or stood up before a wall and filled full of lead. They have no liberty there, and because they have no liberty they have some degree of efficiency and some degree of economy; yet they charge thirty per cent. more for transportation of freight in Japan than we have to pay in this country.

Now when you tell all this to a socialist, what does he say? He says that the old parties are in power in Canada, in Italy, in Germany, and in Japan, but that if we working people were in power things would be different, that we could run the railroad. It may be fortunate for us here in this country that you have a splendid illustration of the working class political party in power running and operating and owning the railways in the Australian states and in New Zealand. There the Labor Party, which is a socialistic party, demanded the socialization of all utility properties, of all mines, forests, lands, retail and wholesale businesses, and all that sort of thing. These countries

for the past twenty-five years have either been controlled absolutely by the Labor Party, or the Labor Party has held the balance of power in all that time; and those are the countries that have gone further in the direction of the socialization of industry than any other countries upon the face of the globe. They not only own the mines, railroads, telegraphs, telephones, but many kinds of manufacturing establishments and wholesale and retail establishments. They own land in Queensland which they use for the purpose of raising cane. I mean sugar cane, not the other kind, and they own factories where they manufacture that sugar cane into sugar. And because they have made this extensive plunge into state socialism they have become the champion debt-ridden states of all this world. Let me call your attention to the fact that on the first day of January, 1914, the combined debts of the Australian states and the commonwealth of Australia amounted to $1,936,000,000, and that on that very same day the combined indebtedness of the forty-eight states of the Union of this country and of the federal government amounted to $1,313,000,000. Their debt was more than $600,000,000 larger than ours and yet we have twenty times their population.

Knowing that these large statistics do not convey very much to your minds, let me put this on a family basis and say that on the first day of January, 1914, that if every family in this country had contributed the sum of $65.00, that sum would have been sufficient to have wiped out the entire indebtedness of all the forty-eight states of the Union and the federal government itself combined. Now how would it be over there? Upon exactly the same basis it would have required the large sum of $1,555.00 from every single family living in those Australian states to have wiped out their indebtedness exactly upon the same basis. Would you like to exchange ours for such a condition? Suppose that you were to wake up to-morrow morning and suddenly find that the per capita indebtedness in this country instead of being $65.00 had been increased to $1,555.00, how would you feel about it?

Now there is another serious thing to consider. Every honest person in the world wants to pay all his just debts. Every honest person who lives in a town, a city, a state, or a nation, wants to see that the public debts are paid; but in Australia it has become the policy to discuss the repudiation of the public debt, and the socialistic parties of

Australia for the past dozen years have had a plank in their platform absolutely demanding the repudiation of the public debt.

Little New Zealand is much worse than the rest. With a population of 1,152,000 their debt amounted to $2,106.50 per family. That was before the war. At the present time the figure is between four thousand and five thousand dollars per family for every family that lives in New Zealand. Another thing, little New Zealand on June 30, 1914, before any war expenses had been incurred at all, raised and expended for the purpose of carrying on her business the large sum of $57,-550,551,000. The population of New Zealand was one-quarter of the population of the state of Ohio on that day. Suppose that in the year 1914, when you expended less than ten million dollars in the state of Ohio for purely state taxes, that in place of that you had expended a sum per capita equal to what the men, women and children of New Zealand expended, what would you have thought of the people of Ohio? You would have had to pay in the form of taxation, directly and indirectly, the enormous sum of $211,000,000, or $201,000,000 more in the way of expenses to your state than what you did pay. If such were the case do you think you would have felt happy and overjoyful? Of course we would arrive at that situation in time if we were to follow the lead of Mr. Hearst and the rest of these self-anointed socialists who are framing the laws for this country and asking that you particularly bend your efforts to the socialization of utility property.

Utility property of course offers the line of least resistance for this socialization, and to the half-baked socialist public ownership looks good. He likes that sort of thing.

In Great Britain, which is sometimes called the "home of municipal ownership" because it has in that direction gone farther than anybody else, we are told by Sir Robert Giffin and by J. X. Snelling, two of the most prominent statisticians that have lived in the last quarter of a century in Great Britain, that due to the plunge of Great Britain into municipal ownership or municipal socialism, for that is the right name for it, that the cities in Great Britain are losing in round numbers, were before the war losing in round numbers, $27,000,000 a year; that in addition to that they were expending the huge sum of $225,-000,000 more than they would have expended except for Great Brit-

ani's plunge into municipal socialism; and that those cities further than that have raised their taxes so enormously and so enormously increased their debts, if you take eighteen of the cities of Great Britain and compare them with the same number of large cities here in America you will find that their debt has increased 300% more rapidly than our debts have increased. More than that, we find that by reason of their plunge into municipal ownership, municipal taxes during the past twenty years have increased in the British cities six times as rapidly as the population. We will arrive here at exactly the same financial condition if we follow the same highway, there cannot be any question about it.

In the year 1870, Great Britain took advice from a lot of those half-baked socialists and proceeded to take over the great telegraph lines in Great Britain. They took them over with a promise that they would give better service and cheaper rates and would have a large sum at the end of each year which they could apply to reducing its taxation. From 1870 down to the breaking out of the war the British Government has lost $200,000,000 in the attempt to operate the great telegraph system of Great Britain. I made that statement before a crowd of 1,500 working men and women in the city of Boston one night and a socialist immediately arose and said: "Mr. Speaker, what do you suppose we care if the British government did lose $200,000,000. Didn't the people get all that money back in the shape of cheaper rates in the sending of their telegraph messages?" I happen to know this socialist very well. His name is Williams, I said, "Mr. Williams, when did you receive or send a telegram?" Mr. Williams was in a hole, he could not remember when he had ever sent a telegram or had ever received one. I said, "There are 1,500 working men and women in this hall. Let every one who has sent or received a telegram in the past six days hold up their right hand." There was not a single hand held up. Then I changed it to six months, and about fifty hands went into the air. I said then, "I have asked you that question for the purpose of demonstrating to you workers assembled here that you are not the class that uses the telegraph. Working people do not use the telegraph hardly ever except in the case of death." Then I pointed to the fact that 96% of all the messages that were sent over the wires in Great Britain were sent by 4% of the

people, and that that 4% of the people represented the great employing fraternity of Great Britain, and the great metropolitan newspapers, and big business, such as manufacturers, bankers, etc. I asked the working class if they wanted to interest themselves in that class of people of whom 4% of the entire people sent 96% of all the messages that went over the wires. I said, "And yet that is what was done by the socialists of that great country, they taxed the forty-five million people of Great Britain to the tune of $200,000,000 in order that the Duke of Bedford with all his large land-holdings could send a message just a little bit cheaper than he had ever sent it before." I asked them, "Is that what you socialists want?" Of course they agreed that they did not want that, and Mr. Williams insisted on coming on the platform, and he was given five minutes to make a speech. After resorting to some considerable personal abuse, he said that he did not have to go around the world to Timbuc too or anywhere else, but he had been born in Cork, Ireland, and that Cork, Ireland, owned and operated its gas plant with great success. I immediately asked Mr. Williams what was the price of gas in Cork? He could not tell; he did not know anything about the price of gas. This simply illustrates the ignorance of the men that carry on that kind of propaganda. When I came on the platform again at my time I said that the people of Cork, Ireland, were paying 58 cents per one thousand feet for gas; that the city of Boston at that very moment was paying 85 cents per one thousand feet, and that at first glance it might be supposed that the people of Cork, Ireland, were getting their gas cheaper than the people of Boston were; but when you consider that the wages and the condition of the middle class in Boston were 250% better than the same class in Cork, Ireland, I was able to prove that the people of Boston were getting their gas at one-half the rate that the people of Cork were getting it. Then I said to the socialist, "I will give you time to come up here on the platform and explain to me why it is that in the city of Sheffield, England, which has had a private gas company in operation for eighty years which has paid 10% dividends every single year since it has been doing business, and is selling gas at the rate of 29 cents per one thousand cubic feet, while right across the way in Birmingham where the city owns and operates its gas plant they are charging 58 cents per one thousand cubic feet of

gas? Nobody came up on the platform of course, because they did not have the facts. They never have the facts. They are always long on theory and short on facts. They remind me of a couple of chaps called Bill and Joe who were about twenty-one years old and decided to go into the fruit business. But neither Bill nor Joe trusted each other; so they sat around and watched each other to see that neither of them ate the fruit. They soon fell out and separated. Six years later they met. Bill said, "Joe, what have you been doing all this time?" Joe said, "I have been in the patent medicine business." Bill said, "I have been in the same kind of business. Let me read you a testimonial." The testimonial read like this: "I was born with my left leg three inches shorter than my right. Upon my right hand I had no fingers at all. Since taking six bottles of your Cure-All Liniment my left leg has grown out to the same length as my right leg, and I have a full set of fingers on my right hand." Joe said, "Let me read you a testimonial that I have." The testimonial read like this: "Dear Doctor Joe, I was born without a liver or lights. Since taking six bottels of your Electric Bitters I have a new liver and electric lights!" (Laughter). These medicine men remind me of the men that are trying to save you. Perhaps you do not think, gentlemen, that they are going to try to get into the White House, but they have already captured a great agricultural state, they have captured North Dakota; and the experience up in Winnipeg recently is liable to be repeated in Cleveland, or Cincinnati, or any other industrial city in this country. I spent several days in Winnipeg during the worst of the riots there. Those Bolshevists up in Canada selected Winnipeg because it was the least prepared of any of the industrial sections of Canada to combat with them. They had worked up the thing for six years. They had carried on an intensive campaign in the province of Alberta for the purpose of converting the working classes of Canada over to their socialistic ideas in all the industrial centers west of Port Arthur. It finally culminated in what is known as the Calgary Convention which was attended by over 260 delegates, and in which they passed a resolution demanding that the Allies get out of Russia and that the Soviet government of Russia be recognized, and demanding a Soviet government for Canada, and saying that on the first day of July they would inaugurate a general strike throughout Canada if

those things were not accomplished by that time. This strike, however, came off on the 15th of May instead of the first of July, because it was a premature affair. Two of the large sections in Winnipeg had gotten into a strike over demanding a particular kind of collective bargaining. They wanted to secure one dollar per hour for the men engaged in their industry. After the strike had lasted six days and they found it was a failure, they then inaugurated the general strike, and the day I arrived in Winnipeg, I found that the Royal Alexander Hotel, perhaps one of the finest hotels on the American continent, had a guest stopping there from Belfast, Ireland, another from Tokio, Japan, several from New York, and others from all around the world. We all had to wait on ourselves at that hotel, because everybody was on strike. The fire department was on strike, the police department was on strike; everybody was on strike, and 30,000 people were rioting. Returned soldiers had been drafted in there as special police, and thirty of them appeared on horse-back in order to patrol the streets of Winnipeg. A mob of 20,000 men collected about those thirty soldiers and flashed packages of newspapers up in front of the horses' heads, while one of the strikers would pull down on a policeman's leg on one side and another one would push up on the other, so that in the course of a moment or two that mounted policeman found himself in the gutter where they could kick the life out of him. They carried that thing on for hours, drove the police off the streets of Winnipeg, and were in absolute possession of the city. Then in order to demonstrate that they had control they spread newspapers upon the streets, collected around in crowds and played several kinds of gambling games with their money on the main street of Winnipeg, thus demonstrating that they had control of an industrial center of 200,000 people. Now that thing could occur in any of your industrial centers if you permit this thing to go on as it has been going on, and sit around and watch and wait, pay no attention to it. "Well," labor says, "we are going to have this thing anyhow." The socialists say that the very fact that the capitalistic system carries with it the seeds of its own downfall means that the workers will overthrow this kind of government and substitute for it a co-operative commonwealth. They say that with the growth and development of the capitalistic system the struggle between the masses and the classes grows even more and more bitter and

that as that struggle grows the middle class will be gradually wiped off the face of the earth or go over into the ranks of the proletariat; that the rich are growing richer. and the poor growing poorer, and that some day—and they have predicted that that day would happen before this—that some day society will wake up and then the people will be divided into two classes, the small class of plutocrats who want to own all the means of production and distribution and all the lines of railway, and the mines, and the lands, and everything, and upon the other side the great mass of the proletariat; and they say, "When that hour arrives the under class will seize possession of all the wealth and everything will be socialized and no one will be able to dispute them or to overthrow that theory of socialism."

Let me call your attention to this fact, that from the day of the first settlement in America at Jamestown in 1607 on down through the history of the young republic up to the year 1860, the workers of this country, the working class, have been able to save and accumulate and invest in the savings banks of the United States $149,000,000. Let us compare that with the year 1912. I select that year because that was a year of normal conditions, that was a year when we had peace. During the year 1912 the workers in this country saved, accumulated and invested in the savings banks of this country $253,000,000. In addition to that they invested $110,000,000 in the building and loan associations; they invested $140,000,000 or more in industrial life insurance of the kind that the workers only patronize. In addition to that they saved $100,000,000 which they invested in homes. They were able to live far better than they had ever lived before, and they sent $1,000,000 more across the ocean to the old folks at home.

At this very moment this great working class of America, 14,000,000 of them, have got $7,000,000,000 in the savings institutions of this country alone; 3,800,000 of them have got $2,000,000,000 invested in building and loan associations of this country. They are not going to the "demnition bow-wows."

Let me call your attention again to the American Federation of Labor Convention held in the city of Seattle four years ago. There was brought on the floor of that convention a report from the Executive Council which said this: "That the degree of civilization in our country is best expressed by the standard of living of the great work-

ing class. There can be no question of dispute of the continual rise of the working class in America, because what we considered as luxuries only ten years ago we count as necessities to-day." When that report came up for a vote in that great convention represented by more than two hundred delegates, of which fifty were members of the socialistic party, it received a unanimous vote. So far as the official proceedings of that convention disclosed, at least there was no vote against it; and if that resolution was correct, then the whole theory of socialism falls to the ground.

"Well," the socialist says, "anyhow we produce all the wealth of the world and we ought to have it." Now did you ever stop to think about that? You know there are three factors in the production of wealth, I mean so far as human beings are concerned, so far as the capitalist himself and the worker are concerned. The first of these is directive ability, and that is more important than anything else. Did you ever ask yourself why it is that you can go into a factory to-day and work less hours than your father or your grandfather did, work less constantly, and yet you produce several times more wealth than he could produce? Why can you do that? It is done because here and there a genius has arisen who invented a labor-saving machine which some other genius had the ability to apply to industry. That is the basis of wealth. If you were to take one hundred capitalists and put them on this side of the hall, and one hundred socialists and put them over here, if they had no brains and no directive ability, and you were to tell them to go ahead and make a living, what would happen? In six months, or six years, they would all starve to death, that is what would happen.

In the year 1867 steel rails sold in this country for $165.00 per ton, and the man who made those steel rails received an average wage of $476.00 per year, working eight hours a day, working longer than they worked in the year 1914. In the year 1914 the men who were employed in the manufacture of steel rails had their wages increased 125% and their hours of labor reduced by eight hours per week, and steel rails were being made for $28.00 per ton. Who caused that vast reduction in the cost of steel rails from $165.00 per ton down to $28.00 per ton? Do you mean to tell me that it was the man who stood there in the rolling mill and pressed his foot upon a lever, or pulled another

lever, or pushed a button, or the man who stood beside him and squirted cold water on him in order that he would not get too warm? Do you mean to tell me that those men could have done that kind of work in the year 1867 as well as they could do it to-day? Of course not. The fact of the matter is that a number of magnificent, splendid labor-saving machines have been applied to that industry. When Carnegie was making 60% dividends in the Homestead Mills, eight miles away in the city of Pittsburgh the Jones & Laughlin Mills in the same county and under the same state government and under the same national government, paying exactly the same amount of wages, and employing same kind of people, were able to make only 12% dividends. Why could Carnegie make 60% dividends while the great Jones & Laughlin Mills, which were larger than the Homestead Mills, could only make 12% dividends? Why was it? The answer is that Carnegie himself was a genius, a sort of double genius. He was not only an inventor, but he had the most wonderful forethought, the most wonderful far-sightedness which enabled him to pick out the men who could operate that industry with the greatest economy and with the greatest efficiency. That was the sole reason and the only reason. So he accumulated probably $500,000,000, most of which he has handed back to society in one form or another. Maybe you and I would have handed it back in a little different way from the way that Andy employed, but anyhow it has all come back, or if it has not all come back what little there is left is coming back.

In the year 1870 it cost the people of this country 44 cents to transport a bushel of wheat from the city of Chicago to the city of Boston. In the year 1914 we were transporting bushels of wheat that same ristance for 11 cents, yet the men operating the railroads of this country had had their hours of labor reduced, and they had had their wages increased by $300.00 per year. Who made that change possible? Was it the man who pushes a crow-bar under a tie on the track? Was it the man who pulled the throttle valve in the locomotive, or the man who walked along and inspected the car wheels when the train came to a stop? No; not by any manner of means; they had not any more to do with that than one of those fans revolving there over your heads. It was again men of genius who caused that great change. So when they say that the workers of the world produce all the wealth of the

world they have not said it all. Just advise the socialists to look these matters up.

Let me call your attention to this fact, too, that over in those socialistic countries of New Zealand and Australia the freight rates there will average 300% higher than they are in this country, yet wages there are 30% lower on some of those socialistic railways in Australia. It costs as much to transport a bushel of farmer's wheat a distance of two hundred miles over there under the reign of socialism as it costs us in this country to take a bushel of wheat from the city of Chicago and land it in the city of Liverpool, a thousand miles by land and three thousand miles by water. Would you like to trade the conditions here for that kind of a situation? What are you complaining about now?

Every day you read editorials about the high cost of living. Everybody is saying that the cost of living ought to be brought down and that it would be brought down if the socialists were in control. What makes this high cost of living? I am going to give you just about two reasons for the high cost of living; one of them is the high cost of wages, the other is the high cost of government everywhere throughout the world. The chief thing that has caused the high cost of living everywhere is the high cost of government. I made a calculation a few minutes ago and I found that during the next twelve months every single family in the city of Boston will have to pay $361.00 just for the fun of being governed, and they get a mighty poor government at that.

"Well," the socialist says, "don't we run the post-office in this country? And if that great institution doing the enormous business of $700,000,000 a year can be run by the government why cannot they run your electric light plants, why cannot they run your railways, your telegraph and your telephone and everything else?"

Well, how do they run this socialistic post-office of ours anyhow? I say without any fear of contradiction that your socialistic post-office is the worst managed big business in all this country. You have millions of complaints lodged at Washington every year, two hundred million of them, and there is not the slightest attention ever paid to them. Perhaps when you walk down by that great post-office building over in Cleveland or in Toledo or some other large city, you have thought perhaps it was a fine building and a great affair, and it never

occurred to you that that post-office building was not paid for by the revenues of the Post-office Department. All the public buildings of this country are built by the Treasury Department. You, and you, and you, have spent $250,000,000 in constructing these buildings. Seventy per cent. of the space in those public buildings are occupied by your socialistic post-offices for which the Post-office Department did not pay a single penny. If they had to pay that legitimate expense it would mean mighty near ten million dollars for rent alone. When we started to do business in the Post-office Department we managed to saddle the salaries of the Postmaster General and his staff on the Treasury Department. They did not amount to much at first, but now that amounts to more than three million dollars a year; that and the free rent they get makes more than twelve million dollars a year. Or, to put it in another way, your socialistic post-office is grafting upon our Treasury Department to the tune of a million dollars a month.

If you will get from the library the Statistical Abstract of the United States, and follow down through the statistics of the revenue of your Post-office Department from the year 1865 to the beginning of the war, you will learn that your socialistic post-office has expended two hundred and eighty million dollars more than it received. If you add to that these indirect losses you will find that your socialistic post-office has lost seven hundred million dollars from the close of the Civil War down to the breaking out of this last war.

Would you like to run your electric lighting business in that kind of a fashion? Would you like to raise your corn, manufacture your cloth, dig your coal, with the same kind of uneconomical methods under which the post-office is operated? When some half-baked socialist like Burleson, who happens to preside over your post-office comes along and states that there is a surplus in the Post-office Department, just remind yourself and your neighbor that governmental book-keeping never keeps books. Nobody knows in any department of the Government whether it is run with economy or not. Down at Washington to-day in the War Risk Department there are 300,000 letters from soldiers that have never been opened yet, they have been lying there for six months. That is the kind of efficiency you get.

Well, you know we have had the same experience in trying to run the railroads. I suppose that it is no exaggeration to say that three

or four millions of men in this country have grown to use profane language over the rotten treatment they have gotten on the government ownership of railroads during the past eighteen months. What did we do? When we took over the railroads on the first of January we immediately took off thirty per cent. of all of the passenger trains with great economy to the government—a great saving. On top of that we increased the price of traveling fifty per cent, and we put twenty-five per cent. more on to the freight rates in addition to the fifteen per cent. which the Interstate Commerce Commission had permitted during the latter part of 1917.

Now in addition to that, Congress created a Revolving Fund of five hundred million dollars; and the only wise thing they did in the whole business was to name that sum a "Revolving Fund," because it revolved itself around, gentlemen, until it revolved itself out of sight, and neither you nor I nor anybody else knows where it has gone. But it has gone, and you have to pay the bill!

The expense of your transportation system for the year 1918 amounted to one billion five hundred million dollars more than it amounted to for the year 1917. You have paid that bill all right in higher passenger and freight rates.

In addition to that loss of five hundred million dollars there is a deficit of $266,000,000.00 which you have got to pay; and the other day Congress created another Revolving Fund of seven hundred and fifty million dollars for the purpose of running that Revolving Fund around a few times and chasing after that other sum! It will go the same way as the other one did.

All of the labor organizations of the country to-day practically are united in a petition to Congress asking them to retain the railroads, asking them to take over the railroads as a permanent thing along with the wire system of the nation. Do you know what it would cost? Inside of five years it would cost us ten million dollars more to run the railroads under government ownership and operation than under private ownership. That ten million dollars will be saddled on to you in higher cost of living. The working man thinks it does not make any difference what it costs, he says that he pays no taxes anyway. Suppose that I own a house and rent it at twenty dollars a month to my friend here; I get twenty dollars a month out of him and out of that

twenty dollars a month what do I do? I pay myself dividends upon the cost of that house; I pay for insurance; I pay for taxes and for upkeep. I say, "I" pay for those things; but it is my friend who pays the bills really. In the same way, if you saddle ten million dollars additional on to the transportation cost you will pay that when you buy yourself a new suit of clothes, when you buy your wife a new bonnet, when you buy a cigar, you pay for it in higher cost of living. That is exactly the trouble. If you want to double the cost of living, permit your government to plunge up to its neck in state and municipal ownership, and you will arrive at that particular point, there is no question about it!

I have had some experience at this wonderful business of carrying on government myself. In the year 1907 we passed a new law for the better enforcement of the Alien Emigration law. Mr. Theodore Roosevelt happened to be President at that time, and I was the first man appointed to office under the provisions of that law. They fixed my salary at $2,200 per year. They did not know whether I was worth twenty-two hundred cents or not. They allowed us five dollars a day for hotel bills and twenty-five cents a day to tip the Pullman porter and all that sort of thing. It took them two years before they discovered that it was economy to divide the country and let the man who lived down Boston way take care of the New England States, and the man who lived out here in Sandusky to take care of this section of the country, and somebody who lived out in the Northwest to look after that section. An ordinary business man would have discovered that in two hours; it took the government two years to discover it. After that, my home being in Massachusetts they handed over the New England States to me. It was a first-rate job, I could not find over three days' works to do in a week, and I was drawing seven days' salary, and I was praying as hard as anybody could pray that the job would last the rest of my natural life. After about six months they appointed George Sheehan of Boston, a fine young man, as Emigrant Inspector to help me at my job. After George had trained with me three or four weeks he was able to do the work as well as I could. Two of us could easily perform all the work of the positions in less than two days, and we were drawing fourteen days' salary; and I did more praying right then and there, I wanted that job to last for-

ever. Seriously speaking, that is only an illustration of the fact that the government requires two men everywhere to accomplish the same result that private ownership will accomplish with one.

Let me give you another illustration. In the great government machine shop of Melbourne where they build freight and passenger cars and where the wages are forty per cent. less than in this country for the same kind of work, they find that they can buy a locomotive from the Baldwin locomotive works and send it all the way around the world to Victoria, thirteen thousand miles, for less than they can make it there, although wages are forty per cent. lower in Melbourne than in Philadelphia. It takes three men in those Melbourne shops to perform one man's labor. In Australia they have a new form of labor called "government stroke." If you were there to-day and were to take a contract to build a line of railway or to build a highway, or a street railway, or to put in an electric lighting plant, it would be specified right in the contract whether it would be free labor or by government stroke. Everybody over there that works for the government regards the government as a great milch cow and they proceed to milk her for all they are worth. Fifty-four thousand people before the war in little New Zealand were drawing a salary from the government. Thirty per cent. of all the people who vote in the Australian States are drawing salary from some sort of government enterprise. That means that when they get a job from the government they perform as little labor as possible. No wonder the taxes there are enormous; no wonder the public debts are so high. They were discussing the repudiation of the public debts of those countries. Now that is the situation which you will confront in this country. I know and you know what we did in 1861 to protect our flag. One half of you shouldered a musket and marched into the South; the rest of you put your hands in your pockets to pay the bill to bring those Southern States back into the Union. What did the South want anyhow? All she asked of the North was to be let alone; but we expended millions and millions of treasure and millions of lives to bring the South back into the Union. I know what you people of Ohio did. You were told most eloquently upon this platform yesterday what the people of Ohio had done to win this last great World War; how you sacrificed in treasure and in the lives of dear ones in order to destroy forever the menace of German

autocracy. Bad as that German autocracy was dangerous as it was, the movement that we face to-day for the purpose of socializing all of the property and all of the industries of America is ten thousand times as dangerous as that secession movement of 1861. That is the peril that you face! And I want to say to you men and women that no higher patriotic service can you render your country than to band yourselves together and inform yourselves and thereby inform your neighbors and friends of the dangers which confront you.

What do these people think of that flag anyhow? Let me cite a little incident that happened in order that you may realize how they regard your flag and your country. On the 10th of February, 1912, before any of the war passion had taken possession of any of us a great public meeting was held in New York City, and Samuel Gompers was one of the speakers who sat in the front on the platform, which was draped with the American flag. As the speakers came forward to the front of the stage somebody had rubbed against the flag and it had got pushed over so that part of it was lying on the platform. When Mr. Gompers was introduced to that audience, looking at the audience as he walked forward, he stepped with one of his feet on the American flag. Immediately a man rose in the audience and said: "I want to call the speaker's attention to the fact that he is treading on the American flag." Mr. Gompers saw that this was true, and he apologized and put the flag back in its place and went on with his speech. Two days' later in the columns of a New York daily that is considered the leading socialist organ of this country there appeared on its editorial page an article written by a leading socialist under the head of "The Flag Incident," in which after reciting what I have just stated, that editorial went on to say this; I am quoting literally, I think, the editorial: ,"If I had been Samuel Gompers when that man rose in his seat and called my attention to the fact that I was treading on the American flag, I would have said: 'Yes; I trod upon the American flag, and more than that, I spit upon it—your flag, not mine, not the symbol of liberty but of wage slavery in America. The stripes upon that flag represent the lashes upon the backs of the workers; the stars represent the bayonet and the bullet wounds in his breast. To Hell with the Stars and Stripes! When the red flag flies above our homes and above our na-

tion, then we will honor the flag. Down with the Stars and Stripes! Run up the Red Flag of Humanity!"

That was an editorial that appeared in a paper that has forty thousand circulation every day in the year; published without much of any criticism, published without any condition being attached to it by anybody in America; published to be sure at a time when our passions were not roused and therefore all the more evidence of the way they regard that flag and what they propose to do with it if they once secure the power!

Let me say further, you may think it is all right to hand over your country to the Red Flaggers; but let me tell you this, that no matter whether a socialist lives in Russia or in South America or in North America, or in the State of Ohio, every leading socialist throughout the world is either an agnostic or an infidel without a single exception, and everybody knows it! They know it themselves they admit it; so that is the thing that you are up against. Mark you, as I said before, the line of least resistance is the kind of property, the kind of interests which you men represent who are attending this convention here to-day. So I say to you, that it is your duty from a double standpoint, the protection of your property, and the protection of your home, and greater than all else the protection of your nation, it is your duty to do whatever you can to overcome this peril.

Columbus sailing across the wide Atlantic discovered the last resting place of the human race. There are no more continents to discover, no more places for you to flee to. To the North the rigors of a cold, inhospitable clime forbid much further progress; to the Southward the miasmatic swamps are a barrier to the Anglo-Saxon race; to the Westward rolls the broad Pacific. Here upon the soil made sacred by the blood of your forefathers who sacrificed so much to hand down to you the finest system of government that the world has ever seen, you are charged with the solemn duty which they also handed down to you of banding together and standing together and seeing to it that this great Republic does not perish from off the face of the Earth!

I thank you kindly for your attention. (Applause).

President Oppenheimer stated that he had been approached by a photographer who wished to take a group photograph of the convention,

and he put the question up to those present as to whether they desired a picture taken. The reply was almost unanimously in the negative.

After announcements as to the banquet feature on this Thursday night, the convention now adjourned until ten o'clock A. M., Friday, July 18, 1919.

ANNUAL BANQUET THURSDAY NIGHT, JULY 17, 1919.

The Annual Banquet of the Association, which was held on Thursday evening, was a highly successful affair, a larger number being seated at the table than on any previous like occasion.

During the intervals between the preliminary courses of the dinner prizes were drawn for and distributed to the ladies by an impartial Committee consisting of Mr. W. S. Culver, R. S. Graves, and an obliging lady whom they persuaded to assist. Mr. Ryan also bore part of their burden in appeasing Fatima.

Mr. Culver was quite witty and happy in his remarks apologizing for the fact that it was impossible to give every lady present a prize, and he had invented a unique plan by which he hoped to escape all censure by drawing out seven or eight times as many numbers as necessary to give one prize, the supposition being that if a lady's name was announced as having been one of the dummy winners that was sufficient for her without getting the prize itself. Whether the ladies all agreed to this or not will forever remain locked as a deep secret in their bosoms.

After this drawing, Secretary Gaskill in a neat speech explained that Past President's Jewels had been provided and would now be distributed to all Past Presidents of the Association in attendance. The following were present and were decorated accordingly: Messrs. Turner, Engel, Beil, Martin, Beckstein, Gaskill, Hutchings and Oppenheimer.

EIGHTH SESSION, FRIDAY MORNING, JULY 18, 1919

The convention met pursuant to adjournment, the President, Mr. I. L. Oppenheimer, in the Chair.

Secretary Gaskill: I would suggest that before we take up the Report of the Transmission and Distribution Committee we take care of some matters that always have to be disposed of in the convention, such as the Report of the Finance Committee, Report of Nominating Committee, election of officers, resolutions, etc., and that after that we take up the Report of the Committee, and by that time I think that most of the boys that are going to attend will be here.

President Oppenheimer: Following our Secretary's suggestion we will again reverse the order of business on the program to some extent in order to clear up some of these routine matters, and then start upon the Report of the Transmission and Distribution Committee by which time we hope to have a little better representation present. Is the Finance Committee ready to make their Report?

Mr. Mason H. Lytle, Chairman of the Finance Committee, presented their Report as follows:

REPORT OF FINANCE COMMITTEE.

July 17, 1919.

The Finance Committee have audited the Association books and find that all items of expenses and receipts agree with the Report of the Secretary-Treasurer.

Respectfully submitted,
MASON H. LYTLE, *Chairman.*

On motion of Mr. J. C. Martin the foregoing Report was received and adopted.

Mr. George E. Miller, Chairman of the Nominating Committee, presented the Report of the Committee, as follows:

REPORT OF NOMINATING COMMITTEE.

To the Officers and Members of the O. E. L. A.:

The Nominating Committee beg leave to report the following recommendations for officers during the coming year:

PRESIDENT: C. H. Howell, Coshocton.

VICE-PRESIDENT: F. H. Golding, Canton.

SECRETARY-TREASURER: D. L. Gaskill.

EXECUTIVE COMMITTEE—

E. L. Franklin, Warren
D. J. Hard, Wooster
Robt. Lindsay, Cleveland
O. H. Hutchings, Dayton
W. A. Wolls, Columbus

ADVISORY COMMITTEE—

W. W. Freeman, Cincinnati
E. P. Matthews, Dayton
J. C. Martin, Columbus

FINANCE COMMITTEE—

Mason H. Lytle, Piqua
Norman McD. Crawford, Columbus
J. T. Kermode, Cleveland

ILLUMINATION COMMITTEE—

G. S. Merrill, Cleveland

METER COMMITTEE—

J. L. Wright, Toledo

NEW BUSINESS CO-OPERATIONS COMMITTEE
LIGHTING AND MERCHANDISE SECTION—

C. G. Eichelberger, Cincinnati

POWER AND HEATING SECTION—

J. C. Matthieu, Dayton

STATION OPERATING COMMITTEE—
Henry B. Dates, Cleveland

TRANSMISSION AND DISTRIBUTION COMMITTEE—
W. E. Beaty, Cincinnati

In the case of the standing commmittee we have recommended only the chairman and suggest that the chairman be empowered to select the members of his committee.

In the case of the Executive Committee, Mr. Oppenheimer, president of last year, having notified the Committee that it will be impossible for him to accept a position on the Executive Committee owing to the possibility of his not being identified with the industry, we recommend that three of the members be elected at this meeting, one for one year and the other two constituting the term of two years each.

The Standardization of Voltages Committee having performed their duties we recommend that this Committee be abandoned.

Respectfully submitted,
G. E. Miller, E. H. Beil, Wm. Long,
J. B. Johnson, J. C. Martin.
Committee.

President Oppenheimer: The Chair will entertain a motion for the Secretary to cast a vote for the election of the respective nominees for the various offices as submitted by the Nominating Committee.

Mr. R. R. Krammes, Newark: I so move.
The motion was seconded.

President Oppenheimer: Are there any remarks? Speak now, or forever hold your peace.

The question was taken and the motion carried, and the ballot cast accordingly.

The several nominees were therefore duly elected to the respective offices named, to serve for the ensuing year.

Mr. J. C. Martin, Columbus: At this time I wish to offer the following Resolution:

RESOLUTIONS

The Ohio Electric Light Association has been assembled in convention at Cedar Point for the past four days. During this time we have been particularly favored in many ways by the friends of the Association.

RESOLVED: At this time we wish to extend our most hearty thanks for the many favors that have been showered upon us. First, we desire to extend our thanks to the exhibitors for the splendid exhibit they have made for the convention and we ask that our members reciprocate this favor by remembering the exhibitors when they need their commodities

This year above all others we have been favored by a series of magnificent addresses. We desire to extend our grateful thanks to Mr. Wm. McClellan for his splendid address of Wednesday morning; to Col. Ralph D. Cole for his inspiring description of the War Time Experiences and his splendid words of counsel for patriotism in this country; to Mr. Wm. A. Durgin for his splendid address on Illumination; to Mr. Freeman T. Eagleson for his magnificent and scholarly address upon the relation of Utilities with Commissions; and to Mr. F. G. R. Gordon for his splendid address on the Trend of Socialism. These addresses hae made our convention a success and we take this occasion to publicly express our approval of the splendid things that have been said.

One of the features of the convention this year has been the splendid entertainment provided by the Entertainment Committee and we wish to express our heartfelt thanks to that Committee for their efforts in our behalf.

To the Hotel that has given every facility possible to make our stay pleasant we extend our thanks.

We have to hope that future conventions may be as good as this one and we urge the friends of the Association to express their approval by helping in the Association work and remembering those that have made it a success.

On motion of Mr. Martin, seconded by Mr. Miller, the foregoing resolutions were unanimously adopted.

Secretary Gaskill: At this time I want as your Secretary to express my great appreciation and thanks for the splendid way in which you have all co-operated to make the work of the Secretary's office easy at this convention. It is not possible at a time like this to give the same service that we probably would in our own home or at our own office, and I do want to express my appreciation and thanks for the splendid help that all attending have given me.

I do not think it is necessary to thank Providence, but we have been favored by Providence with elegant weather since we have been at the Point, and that always helps to make a good convention. We have been favored in other particulars. We have had a large attendance, and we have had more ladies with us than usual. I have grown into the idea—and I do not think I am wrong—that you cannot have a good convention without the presence of the ladies. They have been here in good numbers this year, and I know that those of you who last night sat down at our Banquet and who afterwards saw the ladies over at the ballroom will certainly join with me in appreciation of the fact that they have honored us by their presence.

Now, the hotel accommodations possibly have not been all that we would like to have had. It would be mighty nice if we could shut out all other conventions the week that we have our convention, but of course that seems to be an impossibility, because this place is a popular resort and that magnificent beach out there is drawing not only conventions but a lot of other people. We have been somewhat crowded, yet I cannot help but feel that the hotel has done the best it could under the circumstances. They have given us an Exhibit Hall without charge on which the Association will make a profit of over $1,600.00, which is a great help toward your Association work; and when we remember that they have tried in every way to extend us every facility possible that vote of thanks to them is certainly deserved. They have done a greal deal to make our convention a success.

I do want to thank the members for their large turnout here, although it is not as large as we might have had. One thing that interfered a little was the fact that the Electrical Contractors selected the same week as ours for their Milwaukee convention. One of the members came in this morning and stated that he had just come down from Milwaukee and had found there a good many of the boys who wished

they were at Cedar Point, as they were not having quite as nice a time there as we were having here. I think the Committee will come back to Cedar Point next year, and I bespeak the interest of the members to come and bring your men and make it a great convention.

I think the plan we adopted this year of having at each session an Address along with a Committee Report is a good one, and I think we will stick to that pretty closely the coming year. You know as the conventions come and go we have changed our plans many times. We used to have all papers, then last year we had practically nothing but Committee reports. Now Committee reports are mighty good, but too much of them get to be a little dry. By following the plant adopted this year of having a Committee report and then an Address at the same session we give everybody something that they can take away with them feeling that they have been entertained.

Now there is another thing in which we want to urge your co-operation during this coming year. The Ohio Electric Light Association operates twelve months in the year. You have five splendid Standing Committees. I know that the Executive Committee will give the Standing Committees the same directions that they have in the past, tell them to go ahead with their work and we will pay the expenses of the Committeemen and back them up. The work of the Committees can be made successful by your co-operation and there is no better way of showing that than by sending your men to these Committee meetings. I do not know where they will be held or when, but I have no doubt they will be distributed out over the state so that they will be available to all of you. I earnestly ask your co-operation to make these meetings a great success. The Ohio Electric Light Association stands to-day as the best State Association in the United States; our work is almost international, and other Associations generally are following in the footsteps of Ohio. As you go through with your work, if you can suggest any new plans that will still further develop our work and make it better, the Executive Committee will be delighted to have your suggestions and to carry them out so far as it is within its power.

I do not know that I will speak to you again during this convention because I want to see a splendid discussion of the Transmission and Distribution Committee's Report; but I bring up these Association

matters at this time in connection with these Resolutions of thanks to merely keep you posted as to what we are trying to do for you. (Applause).

President Oppenheimer: We will now take up the Report of the Transmission and Distribution Committee, Mr. R. R. Krammes, Chairman.

Mr. R. R. Krammes, Chairman of the Transmission and Distribution Committee, read the Committee Report, as follows:

REPORT OF THE COMMITTEE ON TRANSMISSION AND DISTRIBUTION OF ELECTRICAL ENERGY.

The Transmission and Distribution Committee begs leave to submit the following report covering the work for the year 1918-19:

Instead of having three open conference and four closed meetings of the committee, the time of meetings was so arranged that an open and closed meeting was held the same day so that there were only four meetings for the whole year. This resulted in quite a saving of time and expense for the committee and at the same time proved most satisfactory.

The work as planned was divided into three parts same as for the year 1917-18, which was found to be most beneficial. These divisions were Underground, Low Voltage Distribution and High Tension Transmission. An open conference was devoted to each division, papers being read and discussion entered into by a large number present. The attendance to all open conference meetings was very good, and the interest shown was indeed most gratifying to the committee.

During the year, Mr. F. M. Hibben found it necessary to resign from the committee and his place was ably filled by Mr. C. M. Rakestraw, Underground Superintendent, Cleveland Electric Illuminating Company, Cleveland.

Believing that some of the ideas expressed in the papers at these meetings would prove beneficial to persons who were not present at any of the conferences, a synopsis of these papers has been added to this report.

Underground

This meeting was held at Cincinnati, December 12, 1918.

AN ELECTRIC UNDERGROUND RECORD SYSTEM

By M. K. Thomen, Superintendent,
The Massillon Electric Co., Massillon, Ohio

The object of this paper was to give a brief outline of the system of records installed by The Toledo Railways and Light Company for their

Electric Underground System; to point out their reason for these records and to direct the attention of those among us who are vitally concerned to the necessity of getting accurate records while the whole information is easily obtainable.

"As a system grows a person scarcely realizes passing the point where more energy is used in making sure of existing conditions than would be required to keep up an accurate set of permanent records. Is a system worthy of its care and should it grow away from us until some urgent need presents itself and we cannot meet the situation face to face?

There are three fundamental points of view upon which to base a record, namely: Operation, Engineering, and Valuation.

The need for an adequate underground record system in Toledo has been felt for some time past, but, until the past year, the necessary steps were not taken to gather in the data and compile it in permanent shape. As a basis for the work the problem was classified so as to make up three main units; the manhole, the duct line and the electric cable. From this, the records resolved themselves into a fairly simple scheme of manhole diagrams, conduit maps and cable maps.

The manhole diagram shows shape and size of the manholes the floor and four walls being shown in detail with all ducts, junction boxes, pipes, and sewer connections drawn into scale. The right of the diagram shows a tabulation identifying the cables on the various walls. With the manhole diagram sheet in hand any cable can be quickly and positively identified. Prints are issued to the Underground Department as changes or corrections are made.

The conduit maps are drawn upon cloth maps to a sufficiently large scale to show the exact location of manholes, tubes and lateral poles with reference to one another and also to curbs, sidewalks, street lines, alley lines, buildings, etc.

The cable map is drawn on a similar cloth map showing outlines only, giving location of cables but an exact detail of their name, size, number of conductors, voltage, etc. These maps are used chiefly for studying and routing of cables. They are also the basis for evaluting the cable system. A very careful check was made to see that all cables were shown continuous from one location to another, that enables names, sizes and duct locations were correct.

An interesting point in connection with the drafting work was that

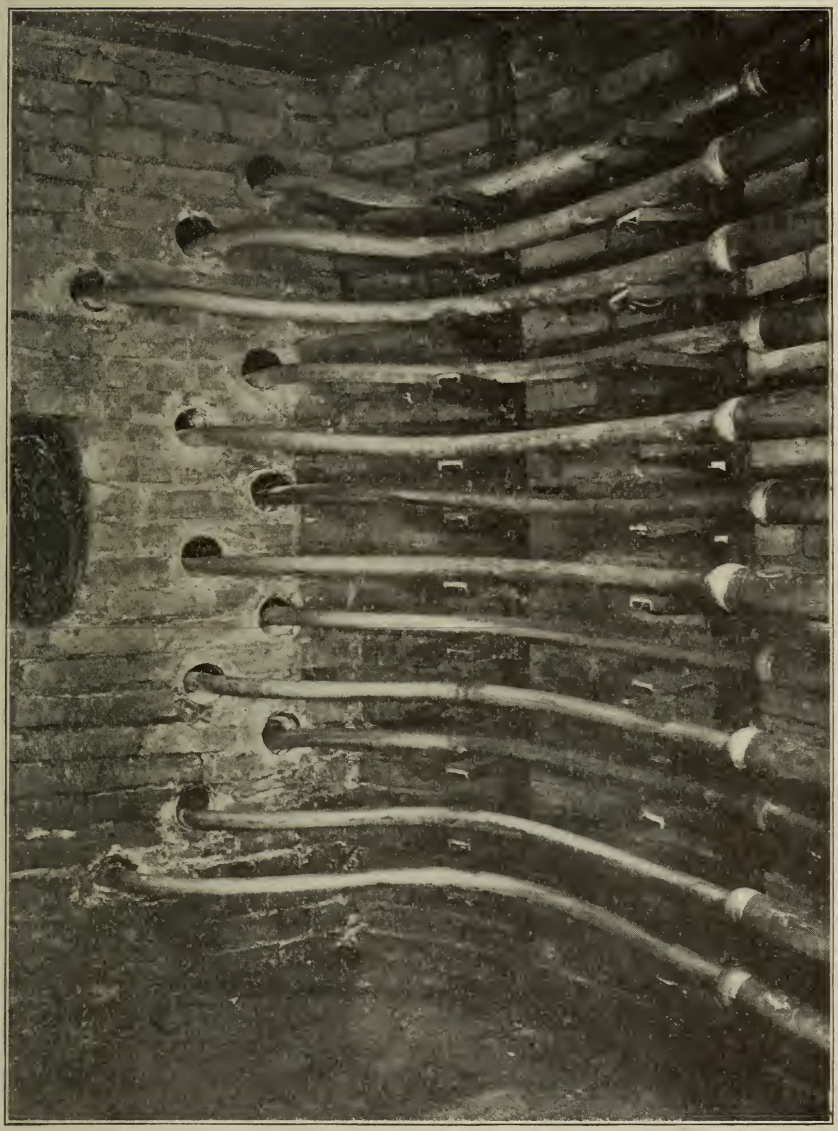


Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

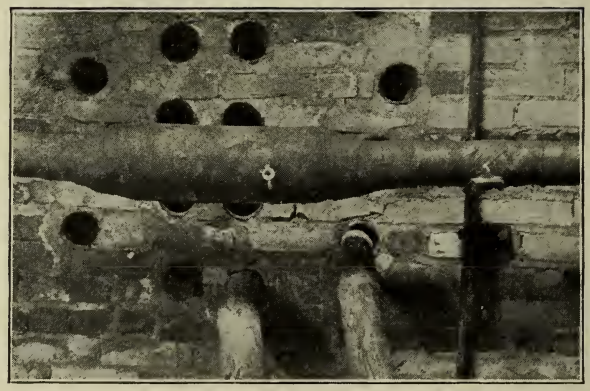


Figure 6

before the survey was completed all of the draftsmen's helpers were women. They were quick to take up the work and proved very efficient. On two occasions they were taken into the manholes, to give them a better idea of the working conditions and to acquaint them with the actual physical conditions of the objects they were helping to draw.

The records are used continually for some purpose or other. Hardly a day passes but what some information is sought from them.

The expense incurred in making a survey was approximately $12,000.00. In addition to this, it keeps one man busy most of the time making changes and corrections. This seems like quite a sum to spend on records alone, but when one considers how quickly money is tied up in an underground system it is apparent that it is not necessary to save many blocks of conduit and cable to offset what might be spent on a survey.

As one result of having the records in shape and understanding more thoroughly the conditions surrounding the underground system, it has been deemed advisable to lay plans for a very exhaustive temperature survey the coming spring and summer. Carrying capacities of cables are limited by cooling capacity of duct lines and some means must be provided quickly to clear up the situation.

In the discussion following the paper several features were mentioned regarding records of other companies and particularly in regard to their schemes of handling records and the organization and management of a record department. It was generally agreed that the record department should be organized as an individual unit and not left as a subsidiary of any department that might see fit to take charge of the work.

DUCT AND MANHOLE VENTILATION AND CABLE PROTECTION

C. M. Rakestraw, Underground Supt.,
Cleveland Electric Illuminating Co., Cleveland, Ohio

The ventilation of ducts and manholes as well as the basic features of design and construction of the manholes, should be arranged with one idea of properly protecting the cables.

The logical place to begin planning for protection of the cables is with the design of the duct line and manhole. Practically all of the

underground systems have adopted the elliptical type of hole, in order to eliminate the sharp bends where the cables come from the duct lines. This kind of manhole is very well adapted to the use of standard forms for concrete construction, and they are quite satisfactory in every way.

Even with this type of manhole, however, there is apt to be considerable congestion where cables come from the duct line, unless the ducts are separated upon entering the manhole. The ducts should be "fanned out" both in width and height, leaving a space of at least the diameter of the conduits between the holes at point of entrance, and still better "staggering" the holes as they enter the wall. This permits a proper separation of the cables and allows them to be trained around the walls without blocking any of the other ducts.

Figure No. 7, shows cables as laid in a manhole with ducts "staggered."

At the intersection of duct lines is where the real difficulty is encountered in properly handling the cables in the manholes. Such a manhole should be considerable larger than the standard. The size suggested is at least 10 feet by 10 feet by 10 feet deep. This size will give plenty of wall space for the proper separation of cables and also allows for a proper expansion of the system.

In dealing with ventilation in manholes, we are concerned mainly with the carrying away of the heat generated in the cable by means of currents of air. Most heat generated in duct lines is carried away by conduction to the surrounding earth. One proposal is to construct transmission subways with a width of only two ducts. One such subway was constructed in Cleveland, but it has not been in use long enough to record any results as to its design. It is more costly than other methods of arranging ducts. Figure No. 2 shows such an arrangement.

The most generally adopted means of ventilating manholes is by means of a vent pipe leading from the manhole to the curb stone of 6-inch sewer tile. Above the ground beside a convenient pole the ventilating pipe consists of a 6-inch iron pipe about 8 or 10 feet high. This vent pipe carries off a certain amount of heat and also provides an outlet for sewer or natural gas which might collect in the subways.

In manholes containing transformers, the vent pipe is not sufficient to carry away all the heat, so there is provided two vent pipes, one connected to the top of the manhole and the other to the bottom, or larger

vent pipe is installed. Another method of improving ventilation is to install in the manhole a blower which produces forced ventilation and proves most satisfactory for manhole which becomes very hot.

The term "Cable Protection" is usually taken to mean some method of protecting the cable in the manhole against mechanical or electrical damage from an outside source. This may be done by isolating the cables from each other by means of some kind of shelves or partitions, or by wrapping the cable with some kind of material which will provide the necessary protection. Any of these means which is adopted should serve three functions; it should radiate readily the heat which is generated within the cable; it should protect the cable from mechanical injury; it should protect the cable from heat caused by a fire in the manhole or by the burning up of adjacent cables.

Figure 3 shows the interior of a manhole with the cables supported on concrete shelves. This method will protect cables from a flash of a cable above or below, but comparatively little from a serious burnout of cables across the manhole. It only protects them partly from mechanical injury.

The best method is to surround the cable with some kind of a wrapping which will answer all the three requirements.

The following description gives a good way of covering cables, and has proven most satisfactory and inexpensive in comparison to other coverings.

First, wrap the cable with a layer of cheese cloth made up in lengths of 4 inches wide. On the top of this a coating of cement and sand is plastered from one-half to five-eighths of an inch in thickness, and on this is wound another strip of cheese cloth. Ordinary bank sand in which there is some loam is used for the mixture, and it is mixed in 2 to 1 proportion with very little water to the consistency of very stiff mud. In winding this on with cheese cloth as above mentioned, the cloth is pulled tight, thus forcing the grout to ooze out between the meshes of the cloth, and this provides a finished outer surface for the cable. It is not advisable to go over this with a coating of neat cement, as this provides too fine a covering and cracks will result.

It is evident that a cement coating of this thickness will perfectly protect the cable from any mechanical injury, and it is a fact that it will protect it from a very intense heat from without.

Figures 4 and 5 show this method of covering cables. Figure 6

shows one finished with a small porcelain knob imbedded in the fireproofing. The hole in this knob allows access to the cable sheath, for the purpose of taking measurements for electrolysis.

LOW VOLTAGE DISTRIBUTION

This meeting was held at Cleveland, February 20, 1919.

INDUSTRIAL POWER SUBSTATIONS

By G. B. Schneeberger,

Cleveland Electric Illuminating Co., Cleveland, Ohio

Outline—For loads under 600 Kva. 2300 and 4600 volt installations it is usually preferable to mount the transformers on a pole structure. On account of the good ventilation obtained by this construction, heavy overloads can be carried.

2. In the more congested districts where it is undesirable to erect a pole structure or where indoor types of transformers are to be used, it is necessary to house the transformers in so-called transformer vaults. The primary supply for these installations is brought in by means of underground cable.

Some of the more important points considered in establishing a transformer vault location are:

(a) It should be as near the central of distribution as possible, so as to minimize the low tension copper expense.

(b) The location should be such the primary will not be disturbed or damaged during alterations on the premises. The primary cable should not be near steam lines.

(c) The location should be such that satisfactory ventilation will be obtained.

(d) The vault should be readily accessible, so that damaged transformers may be easily changed.

(e) The location should be such as to allow extension without difficulty in case additional capacity is required.

(f) Basement locations should be avoided on account of the difficulty in installing the transformers, and in securing satisfactory ventilation.

(f) Mechanical ventilation is undesirable. If the blower should fail, or the attendant fail to start it, the transformers are likely to be damaged.

3. The transformer vaults for 2300 and 4600 volts are built of brick or concrete block, with corrugated iron roofs. Separate compartments are provided for watthour meters. Automatic oil switches with self-contained series trip coils are connected in the primary side of the transformers. These switches are used as service switches and are mounted so that they may be operated from outside the transformer compartments.

4. The heavy power consumers, such as electric furnaces, rolling mills, and large manufacturing plants, are supplied direct from the 11,000 volt system, which is entirely underground. The transformer vaults for these installations were formerly built of corrugated iron; but during the past few years, brick has been used, chiefly because of difficulty and delay in getting iron.

The switches and primary metering equipment are mounted in cells of brick in sandstone barriers. In most cases duplicate service cables are installed. These cables usually terminate in interlocked, hand-operated automatic oil switches. The switch handles are so mounted that, in case one cable fails, the local electrician can switch to the other cable without entering the transformer vault.

VOLTAGE REGULATION OF DISTRIBUTING FEEDERS AS A MEANS OF IMPROVING CENTRAL STATION EFFICIENCY

By Frank Hershey,
General Electric Company, Schenectady, N. Y.

In planning new generating station, or in improving existing stations all the factors entering into economical productions are carefully analyzed. The same degree of care should be exercised in planning the distribution system. For instance, the wattage and candlepower of Mazda Lamps vary at the rate of slightly more than 1.5% and 3% respectively, for each 1% variation of voltage from normal. Therefore, if the voltage applied to the terminals of a lamp is 3% low, the revenue of the central station will be 4.5% below normal, and the illumination to the consumer will be 9% below normal; so that both station and consumer lose. Or if the voltage is 3% high the revenue will be 4.5% above normal; and, while the illumination to the consumer will be 9% above normal, the life of the lamp will be so reduced that he will be dissatisfied.

The power consumed by household appliances, such as irons, toasters, percolators, etc., varies as the square of the voltage; so that if the voltage is 3% low, the power consumed will be 6% below normal, and the service will be unsatisfactory. Therefore, it is important, for the satisfactory operation of these devices, that the voltage be regulated as closely as possible. While the load due to lighting and household appliances may be small compared to the total load, it is usually the standard by which the public estimates the efficiency of the operating company.

Normal voltage may be maintained at the distribution center (a) by supplying constant bus voltage, and having feeders of negligible drop, or (b) by varying the voltage supplied to the individual feeders by means of voltage regulators which will compensate both for the drop in the feeders and the voltage variations at the bus. Even with constant bus voltage, on account of variations in length of feeders and power demand, the voltages at the distribution centers will vary widely; unless each feeder voltage is controlled separately. Recording voltmeter charts taken from time to time provide a means of detecting voltage irregularities. In laying out a new system or reconstructing an old one the load districts should be divided up so that the feeders will be as nearly equal as possible, in order to standardize the switchboard and auxiliary equipment as far as possible. But it is sometimes difficult to predict how the load will develop.

As a specific example, to determine whether or not a regulator should be used, assume that it is necessary to install a single phase 2300 volt, 75 ampere, lighting feeder, to carry the equivalent of full load 4 hours a day, 300 days a year allowing 15 years' life. Allowing 20 cents a pound for copper 7% for taxes and interest, 15 cents a pound for scrap copper line loss energy at 1.25 cents per Kw. H., the most economical size of wire would be No. 1. The cost per mile would be $184, and the drop 4%. If not corrected on a lighting load, this drop would involve 6% loss in revenue to the company, and 12% less in illumination to the consumer.

To maintain voltage within 1% of normal without a regulator would require 350,000 c. m. conductors at a total cost of about $258 per mile. No. 1 conductors and a regulator to give the same regulation would cost about $278 for one mile. As the length of the feeder is increased the cost of the regulator per mile would become less and less. For two

miles of feeders 1% regulation without a regulator would require 1,500,000 c. m. conductor at about $354 per mile, while No. 1 conductor and a regulator would cost about $231 per mile.

For alternating current voltage regulation on distribution feeders the variable ratio transformer is best. In the induction regulator, the secondary, which is connected in series with the feeder circuit, is wound on what looks like the stator of an induction motor. The primary, which is connected across the feeder terminals is wound on the rotor element. By rotating the rotor element of a single phase regulator, the voltage induced in the secondary can be varied. In the case of the polyphase regulator, the phase relation of the secondary emf. to the line emf. is varied. In either case the supply voltage is raised or lowered as the load on the feeder increases or decreases.

The induction regulator requires very little attention, and may be installed at the generating station, the substation, or outdoors, depending upon requirements. The automatic induction regulator requires an auxiliary equipment consisting of potential transformer, contact making voltmeter, relay switch, one or more current transformers, and a line drop compensator. The contact making voltmeter is connected to the secondary of the potential transformer and responds to variations in line voltage. When these variations exceed 1% either way from normal, the contact making voltmeter closes the relay switch circuit. The relay switch then closes the circuit of the motor which rotates the primary of the regulator. The primary rotates until the voltage becomes normal. Then the control circuit is automatically opened and the motor stops. The current transformers and the line drop compensator reproduce in miniature the resistance and reactance drops in the line, and are so connected in the contact making voltmeter circuit that the regulator can maintain constant voltage at a distant load center regardless of load or power factor Since the contact making voltmeter is operated from one phase, when a polyphase regulator is used the voltages on all phases will be changed equally.

Two single phase regulators will control two of the phases independently. The regulation of two phases will tend to hold the third phase voltage constant. When three single phase regulators are used, the voltages on all three phases will be controlled regardless of unbalancing. With a balanced three phase load, a three phase regulator will give the same regulation as two or three single phase regulators.

In controlling a three phase, three wire circuit, two single phase regulators will give as good, or better regulation than one three phase regulator. If the unbalancing becomes excessive a third single phase regulator will be necessary. Two single phase regulators cost about as much as one three phase regulator. For three phase four wire feeders, three single phase regulators should be used. If the load is unbalanced an additional line drop compensator, and current transformer in the neutral will be necessary. For a two phase four wire feeder, if the load is unbalanced, a two phase regulator will be satisfactory. For a two phase three wire feeder, with either balanced or unbalanced load, two single feeders should be used.

The power demand does not always develop in accordance with the estimates of those who lay out the feeder systems. Where the load has increased more rapidly, or where the service has to be extended further than was expected, pole type regulators can be used to maintain satisfactory regulation at local point.

Where small generating stations are shut down, the localities served by transmission lines, regulators located in the substations will compensate for variation in transmission voltage, as well as the drop at the local center of distribution.

High Tension Transmission

The conference at Dayton held April 17th was devoted to the general subjects of Transmission Lines and Oil Circuit Breakers. Papers were presented by Mr. Frank Howard of the Wheeling Electric Company and Mr. J. B. MacNeil, of the Westinghouse Electric and Manufacturing Company. The following report is in the nature of an abstract of these papers and of the discussion which took place upon them.

Transmission System Design and Operation

Modern practice in the design and operation of a transmission system is well exemplified in the 132 kilovolt system recently constructed for connecting Canton, Ohio, with the new Windsor Generating station on the Ohio River.

At the main power station energy is supplied by 30,000 KVA. units generating 11,000 volts. The main generator bus is ring shaped and a set of reactors of 45,000 KVA. capacity is inserted in the bus between each pair of generators. Whenever a generator is removed from ser-

vice the corresponding bus reactor is cut out of service by a short circuiting oil switch, which closes automatically through an interlocking arrangement of control circuits. Conversely, when a generator switch is closed, the corresponding bus reactor is automatically cut into service.

The auxiliary motors of each generating unit are supplied by separate transformers. General station auxiliary motors are fed from two additional transformers; the general plan being that there can be normally no interchange of power between any two transformer banks. Trouble which might originate in any particular piece of auxiliary apparatus is therefore not likely to affect more than one main generating unit. Throughout the whole power plant design similar care has been exercised to provide against possible interruption of service.

The unit method of operating transmission lines and transformers is used. Each of the two 132 KV. lines is provided with its own bank of step up transformers at the generating station and with its own bank of step down transformers at the receiving substation. Under normal conditions there is no paralleling of lines through a common 132 KV. Bus at either end. Means are provided however, for such a paralleling in case it is desired to remove any transformer bank from service temporarily. The unit system of operating lines and transformers makes it possible to do switching from the low tension side, thereby relieving the equipment from high voltage disturbances which frequently arise when switching is done on the high tension side.

At the receiving substation are two 7500 KVA synchronous condensers operating from 6600 volt tertiary windings on the step down transformers. These tertiary windings of the two transformer banks are paralleled on a 6600 volt bus just as the main low tension windings are paralleled on a common 22,000 volt bus.

A very careful and regular patrol of the transmission lines is maintained. Stocks of line material and tools are kept at substations and supply depots along the line, not to exceed ten miles apart. Prompt attention is given to making any repairs which the patrolman's report may indicate as urgent.

The right of way for the transmission lines is covered by easements which allow the land owners to use their land for farming purposes. No disadvantages of this arrangement have as yet developed.

Types and Rupturing Capacity of Oil Circuit Breakers

The problem of oil switching at power plants and substations has

received a great amount of attention in the last few years due to the enormous generating capacities which have been built up and which impose correspondingly great burdens upon switching equipment opening under short circuit conditions.

New developments by the manufacturers have been mostly along the line of the "tank" form of breaker, in which the chief feature is the "dead" oil tank supported from the main frame of the switch, except for the extremely large sizes, the design is such that the tanks can be lowered by a windless mechanism, allowing convenient inspection and adjustment of the contacts. Details of construction vary widely in the different makes of switch, but the things which all of the best will embody are as follows: Contact surfaces should be self-cleaning as the breaker closes; the arcing tips should remain closed until the main contacts are well parted and should draw out the arc away from the main contacts. Burned oil and metal should fall to bottom of tank without dirtying the surface of the active parts.

Provision should be made to withstand and dissipate severe pressures established by the arcing. Bushings should be of a form easy to keep clean in order that the standard flash over voltage to ground of 2¼ times rated line voltage, will not be reduced.

The rupturing capacity of breakers has been rated in KVA. the product of line voltage and maximum current in the circuit which the breaker can successfully interrupt. To determine the capacity of breaker required for a given installation, then, it is necessary to compute how much current can flow at the given point under short circuit conditions. Manufacturers are now supplying tables of data and curves for assisting in this computation, showing the characteristics of generators, transformers, transmission lines, etc. Where the short circuit current is limited principally by generator reactance, the amount of time required by the breaker to trip, or the time setting of the controlling relay, has an important bearing on the short circuit current and this factor is therefore taken into consideration in the generator characteristic curves. Where breakers are used for protecting relatively small transformer banks the reactance of the transformers is usually so high in comparison with that of the balance of the circuit that the latter can be entirely neglected in the computation of short circuit current without materially changing the result.

The present method of rating breakers as to rupturing capacity is

to state the maximum current, at the rated line voltage, which can be interrupted twice with a two-minute interval intervening, the breaker to remain in suitable condition for further non-automatic use. If the two-minute interval between first and second operation is reduced, the capacity of the breaker will not be as large. Introduction of automatic reclosing circuit breakers may necessitate rating breakers on a somewhat shorter time interval basis.

In the testing of breakers, oscillograms are taken and the current which the breaker is said to open is the R. M. S. value of the first wave on which voltage appears across the arc. In a typical test case on a large system, the breaker was found to open six cycles after the short circuit occurred and the arc was extinguished at the end of nine cycles.

Respectfully submitted,

R. R. KRAMMES, *Chairman.*
W. E. BEATTY,
C. A. HARRINGTON,
M. E. GRAH,
A. M. WILSON,
J. B. JOHNSON,
C. M. RAKESTRAW,
Committee.

Mr. R. R. Krammes, Chairman: In closing I wish to thank Mr. Gaskill and also the members of the Committee for their co-operation. I think the work this year was of a very good class and certainly appreciated by every one. (Applause).

President Oppenheimer: Gentlemen, you have heard the Report of the Committee, and it is now open for discussion. It is desired that the discussion on the Underground Section be opened by Mr. McCabe, of the Electrical Engineering Department of the Detroit Edison Company. Mr. McCabe is not present, but his discussion will be read by Mr. Grah, of the Engineering Department of the Toledo Railways and Light Company.

Mr. Grah read the discussion, as follows:

DISCUSSION ON UNDERGROUND PORTION OF OHIO ELECTRIC LIGHT ASSOCIATION REPORT DECEMBER 12, 1918.

G. B. MCCABE, THE DETROIT EDISON COMPANY.

The three fundamental points of view upon which to base a record, viz. Operation, Engineering, and Valuation, are well chosen.

Our underground record system is based upon practically the same three main units as outlined in the Report, the headings being as follows: (1) Manhole and manhole equipment, such as hangers, supports, etc. (2) Duct line or tunnnel; (3) Electric Cable and Junction box.

In 1900 when our conduit system was in its infancy, conduit maps were drawn to a sufficiently large scale to show size and number of ducts and exact location of manholes, all with reference to one another, and also to curbs, street lines, buildings, etc. As the conduit system grew in extent, more and more territory had to be included on the maps, requiring a reduction in scale, which resulted in congestion of the necessary data to be tabulated. Therefore, it was decided to adopt the system, which is in vogue at present, of showing on fairly small scale maps, the conduit runs and manholes, with cross-sections through the ducts giving the number and location of every cable therein. The minor details concerning the exact location of duct runs, location, shape, size, drainage, etc., of manholes is worked up in field books, all of which are kept in the office files.

Reocrds are kept of every junction box manhole in the D. C. district, showing the size and location of the junction box, the cables emanating therefrom and the duct which each cable occupies.

Because of the fact that considerable underground data is required by other departments, there has recently been developed a system of records, whereby a set of loose-leaf folders are made up with blue printed sheets containing all the necessary information regarding the following: D. C., feeders and mains, railway feeders, A. C. transmission and distribution cables, D. C. feeder and main junction boxes, services, wall boxes, and drain, bond, exit, pressure wire, dead, and telephone cables. All information such as kind, size, location, date of installation, changes, work order, department order, etc., are given therein.

We also keep up several other maps on which are shown: the steam system, steam gauge lines, D. C. neutrals, feeders and mains, steam, telephone and recorder system, pressure wires, wall boxes, paving map, and private telephone.

The underground records are made the most use of by the following five departments: Underground Lines Dept., Property, Lines Costs and Records, Electrical Engineering and Distribution Engineering Departments.

To keep these records up to date, approximately four people are required the year around. One of these is a young lady who has been characterized by the superintendent as one of his "best men," and who has also been made familiar with manholes, tunnels, etc., by inspection trips.

During the summer months we send two men over a route covering those manholes, which because of many or heavily loaded cables passing through them, are expected to show some pretty high temperatures. Upon finding dangerously high temperatures 120 degrees Fahrenheit, steps are immediately taken to furnish relief.

Our records on the whole are handled by one department—the Lines Costs and Records Department. This is in accord with the concensus of opinion at your meeting.

Our manholes are of the elliptical type, averaging 7 ft. long, 5 ft. wide, and 7 ft. high. We still use the brick construction, although we are contemplating the use of concrete in the outlying districts.

While we consider the fanning out and staggering of the ducts at the manhole a good idea, we have not as yet adopted this method of installation.

Because of the undue congestion in a manhole at the intersection of two duct runs, instead of enlarging, we cross-connect our manholes, i. e. ducts are installed from a manhole in the east and west run to a closely situated manhole in the north and south run. This has been found to work out very well.

With regard to ventilation of manholes, very little in this line has been done by us, owing to the fact that we have no transformers installed in our manholes. There are perhaps not more than a dozen vent pipes on the whole system, a couple of which tap the shaft to a tunnel under the river, where pumps draining the water from the tun-

nel are liable to stir up considerable moisture. A blower mounted on a small truck has been used to force air into particularly hot manholes. The obstruction which this unwieldy thing causes in the street makes its use very inexpedient. We are interested in the manhole mentioned in the Report and would appreciate additional information concerning it.

We have eliminated the most common cause of mechanical injury to the cables by the installation of light galvanized iron ladders in every manhole, affording an easy means of getting in and out of a manhole.

We are still on the experimental stage and are open to suggestions with regard to a suitable cable covering. We have been using a wrapping of composite metal lath covered with cement, but its use has been temporarily discontinued because of the interference by the lath to signal currents in fault location.

The idea of inserting porcelian knobs in the cement covering to afford contact to the lead case for electrolysis measurements is very worthy of consideration.

Mr. Grah, at one point in the reading of the foregoing remarked that the Toledo plant had taken on some girls for this work in which they had been very successful in getting them pretty well lined up so that they did the work almost as well as men, although the management did not feel like sending them down into all of the holes.

President-Elect Howell (In Chair): I am sure this subject is of intense interest, particularly to the larger operators, and I invite its fullest discussion. If no further discussion is desired under this division of the topic we will pass to the discussion of tendencies in transmission line work, which will be opened by Mr. H. R. Summerhayes, Assistant Engineer of the Lighting Department of the General Electric Company.

DISCUSSSION BY MR. H. R. SUMMERHAYES, ASSISTANT ENGINEER LIGHTING DEPARTMENT, G. E. CO., SCHENECTADY, NEW YORK.

Mr. President and Gentlemen:

As the Department Engineer of one of the large manufacturing companies I am frequently called on in case of operating troubles with

transmission or distribution systems to make an investigation and recommendations as to how to remedy the trouble. The relation of the manufacturer to some of his customers is like that of the Chinese doctor to his patients. As long as the patients are well the doctor is paid, but when they become sick the doctor's pay stops until they get well.

I was recently in one of the large cities on perfectly legitimate business and I happened to run across the Vice-President of a local company, and he wanted to know what was the trouble, he had not heard of any trouble, but when he saw me he thought there must be some trouble.

It is a pleasure to me to meet operating men at a time when you have forgotten your troubles temporarily. We manufacturers always have a great deal to learn from the operating men. We can make tests in our laboratory, but the results from these are never as satisfying as those made under actual operating conditions. We therefore make a very close study of operating conditions in order to be sure that our tests will parallel those conditions.

In regard to the Report of the Committee on Transmission, I find there is little to add to the description of the Windsor plant. The arrangement to avoid high tension switching is very good and commendable. High tension switching should be avoided so far as possible; but we find that as the systems grow it cannot be avoided. There may be several generating stations and if you try to arrange for low tension switching throughout there is considerable complication and the result is that some high tension switching must be done; therefore it becomes necessary to insulate the apparatus and bushings so that the stresses incurred by high tension switching will be withstood with a reasonable factor of safety; and that is what we endeavor to do.

The first thing in looking over a system when making an investigation is to arrive at a correct diagnosis of the troubles, and that is sometimes rather difficult. I was called upon some time ago to investigate a case of high frequency. In this case it was the underground cables, which had been installed for several years, had been operated at reasonable loads and had always been very good cables and had given no trouble. Suddenly they began to give trouble, breaking down right and left, and the diagnosis of the operating engineer was high frequency, due as he thought to some additions to the system. He could not really

understand where it came from, but judged it must be high frequency because the cables were good cables and had stood for many years. So we started investigating high frequency for any spark gaps, reactances, trying to detect high frequency. At the same time I got samples of some of the cables, tested them, and soon found that the real trouble was high dielectric losses in the cables. They had simply aged, and the dielectric losses were so high that the cables could no longer be operated at anywhere near full load. That shows how easy it is to fall into an incorrect diagnosis of troubles.

When the troubles are of the nature of high voltage, when we get break-downs and flashing-over, arcing over, we find that grounding the neutral is possibly the most universal remedy; in fact, most of these high voltage troubles seem to come on systems which have not the neutral grounded, and when we ground it we do not hear any more complaint of the high voltage. So the systems throughout the country seem to be grounding their neutrals more and more, especially as the systems get larger, it seems to be more and more necessary.

Another thing that we have found a tendency to increase the use of is the synchronous condensers. As the transmission systems expand the tendency is to tie into other sytems until the complete system occupies and covers a large extent of country, with probably several generating stations, and it becomes necessary to maintain the voltage within reasonable limits all over the system. In order to do that, since you cannot install generating systems at every point, synchronous condensers are put in, primarily to maintain the voltage, but incidentally they have a very good effect in raising the power factor of the system. I think it is not generally appreciated to what an extent a low power factor influences the losses and the investment in the system. An investigation was made by one of the large companies operating a network supplying a number of stations, the total load running up to 60,000 Kw. They went pretty carefully over this system and made a rather elaborate report. They valued the apparatus, investment in buildings, rights of way, hydraulic apparatus, steam apparatus, and the effect of the power factor in the electrical apparatus and lines which are affected by the power factor, and it was found that the variation in investment was somewhat as follows: Dollars invested per Kw. customer power demand, at one hundred per cent. power factor, $350.00; at eighty per

cent. power factor, $385.00. With ten per cent. increase in the entire plant covering everything in the electrical part the percentage was of course much greater. The total Kw. hr. generated per 24 hrs. per Kw. demand of customer, from 100 to 80% power factor, about 2% increase. The investment in generators, high voltage transformers, high voltage line, and medium voltage transformers and lines on that particular system amounted to about $55.00 per Kw. of customer's demand at one hundred per cent. power factor; at eighty per cent. power factor, $83.00, an increase of $27.00, or nearly 50%. That is taking in all of the electrical apparatus. This particular concern is now putting in a number of synchronous condensers at various parts of the system in the endeavor to deliver more Kw. hrs. for their existing investment, which they will do.

As far as losses are concerned, it is generally found with the synchronous condenser that you save enough to pay for the losses in the condenser, and then there is the improvement that you gain by raising the power factor, improvement in regulation, etc., which are net to the good. In connection with this improvement in power factor it is of course desirable to go as close to the source as you can, that is, install the condensers near the place where the low power factor originates, and then you make a gain in line losses and regulation all the way along the line from your demand to the generating station.

There has been a recent development in tin foil condensers, static condensers, the manufacture of which has been improved so that they can now be sold at what might be called popular prices. I have some lantern slides but am not able to present them. Roughly you can say that up to sizes of 1,000 KVA. it would pay you to investigate the installation of a static condenser instead of a synchronous condenser; that is to say, the losses are so much less that the operating costs are very much lower for the static condenser, that is up to 1,000 K.V.A.; whereas beyond that capacity that cannot be said, for there you do not get the advantage that you would get by a synchronous condenser, namely, close voltage regulation; but you raise your voltage at the customer's sub-station or at the customer's switch, and obtain a higher revenue for that reason.

There have been meetings in the last year or two of representatives of manufacturing companies with some of the N. E. L. A. to establish

standard transmission voltages; and I understand that that matter is to be presented to the American Institute of Electrical Engineers to standardize nominal voltages for systems of 66,000, 88,000, 110,000, 132,000, 154,000, and 220,000—all multiples of eleven. You will notice there one big jump from 154,000 to 220,000. It is believed that there will not be many systems installed at intermediate voltages. There are a number of 150,000 voltage systems, and these will be rated at 154,000. The idea is, that at these high voltages it is desirable for the manufacturers to standardize the bushings which will fit the transformers, lightning arresters, and switches, and be interchangeable so far as possible for the different pieces of apparatus; and since these lines of bushings are expensive and difficult to develop, it is desirable to have as few sizes as possible in the interest of the whole industry. For that resaon this standardization of voltages was undertaken, as well as other apparatus such as switches, lightning arresters, transformers, etc. The cost of transformers is affected by standardization, because although transformers can be wound for any voltage, yet the more you get out of one voltage the cheaper the transformers become.

Now with respect to tying in transmissions systems where the power may be generated at several stations that exchange power and the power has to go in either direction, you must have some control of the power factor; that is to say, you can transmit power with voltage equal at both ends if the receiving end supplies all the idle current; but that is rather hard on the receiving end. So in order to control the power factor it is easy to put in synchronous condensers with voltage regulators and then you will have flexibility in your generator voltage so that you can go up and down, and you will have flexibility in the transformer, or you can put in induction regulators; which of these is the best to do depends on the particular requirements. I think it is desirable when ordering transformers for tying in purposes to have considerable flexibility in the transformer voltage and to have a fair number of taps, and have your operating voltages so arranged that they are somewhere in the middle of the range. The company with which I am connected has developed tap switches on the primary so that the taps may be changed without going into the transformer; then there will be a crank and a dial on the top of the transformer which can be locked if necessary. By turning that crank the different

combinations of taps may be obtained in the switch under the oil. This switching is done when the lid is off. I think that it is a very desirable thing for the banking and tying in of transformers in order to get your voltage just right and according to the direction of the power, so as to control your power factor. That is more or less of a new development. On transformers for 60,000 volts and over we have now standardized what we call a conservative tank. That means that the transformer is always completely filled with oil right up to the cover, and there is a little auxiliary tank above the transformer in which there is a very small area exposed to the air. That arrangement reduces the amount of moisture that is taken in in the transformer in controlling the tension. It has been found that in a transformer of the ordinary construction with the oil level below the cover there is quite a large area underneath the cover, and as the temperature varies up and down a little air is drawn in, and some condensation results on the cover so that moisture gets in to the oil and gradually the oil deteriorates from the moisture. A very small quantity of moisture makes a great difference in the break-down point of the oil. So, in order to minimize that trouble we have introduced for high voltages this conservative tank where the transformer is completely filled with oil and the only area exposed to the air is the very small area at the top of the tank, and arrangements are made for taking care of any moisture that gets in there.

One important problem in the transmission field is insulators. As you know, we are very active just now in the insulator line. We have discovered with the oil interlinked type of insulator, if the mechanical working load can be reduced to three or four thousand pounds, we are inclined to believe that that insulator will outlast the cemented tie. The porcelian must be good, of course. It is rather difficult to make good porcelain, but the various companies manufacturing it are now making good porcelain, I think they have found out how; and the porcelain itself apparently does not deteriorate; but when you combine steel, cement and porcelain, substances having different degrees of expansion, and remembering that the cement may absorb moisture in the course of years, you have a combination which may give trouble. Some of the interlinked type of insulators have been in service ten

years on one hundred thousand volt systems with the loss of only one-half of one per cent.

Now in reference to oil circuit-breakers, my friend Mr. McNeil in the Report here makes a statement that "New developments by the manufacturers have been mostly along the line of the 'tank' form of breaker", and he specifies that the tank should be made strong enough to withstand severe pressures. I wish to amplify that statement a little. There is another way of taking care of the pressure, and the recent developments in our manufacture have been along this line: We apply the principle of the H switch which is used on circuits up to 20,000 volts, to high tension switches. In the H switch you will remember that there is a very small and very strongly built tank with baffle blades in it, and a rod comes out through a very small hole. Now the arc has to pass through that hole at the same time and strike the hole under high pressure generated by the arc itself passing through that hole. When the arc is weak the stream of oil tries to occupy all the space there and extinguishes the arc. A heavier short circuit higher pressure forces the stream of oil through that small hole when the arc is trying to get through, so that the more Kw. you are rupturing the higher the pressure you have to extinguish the arc. Our recent development in high tension switches is along this line; we take an H oil switch-pot, turn it upside down and let the rod come out at the bottom into a small hole, which we call an "explosion chamber," then the whole thing is immersed in a large tank of oil so that in rupturing the arc the high pressure developed is taken up by the explosion chamber and the pressure in the whole body of oil is gradually developed as the arc and the oil close this small hole. We avoid shock on the main tank. The pressure is developed so gradually that the air at the top of the oil level has a chance to absorb that pressure, whereas if you rupture an arc without any explosion chamber in the large body of oil, the pressure is transmitted instantaneously in every direction, and you must make your tank strong enough to stand it. I just want to point out that there are two ways of doing this. One is to make the tank strong enough, the other way is to take care of the pressure in the small explosion chamber.

We have another development that we have planned and are working out. We are now building a complete line of switches with ex-

plosion chambers from 15,000 Volts up to 150,000 Volts. Switches may now be obtained as low as 15,000 Volts.

Another tendency with which you have all been familiar is the use of out-door apparatus. This started with high voltages and has now gone on to, as I say, switches, transformers and lightning arresters. Switch-board panels are mounted in water-proof houses. So that everything can be obtained for out-door work as low as 15,000 Volts. For 2300 Volts we make switch panels and switches complete in little houses so that you do not have to build a whole station, but can do everything out-doors when necessary.

Out-door generating stations have been planned. I do not know as yet of an out-door hydro-electric generating station actually installed, but I know of a number that have been planned.

There is another tendency to which I want to call your attention, and that is the automatic operation of stations. We started in on that some six or eight years ago. We put in an Edison station and Rotary Convertor without any attendant. Detroit now has five stations of that character. Since then an automatic railway sub-station has been developed, and my company has some twenty-five of those stations in operation, and sixty or seventy more ordered. I believe that the automatic station will do a great deal toward reducing cost of operation. It will not do away altogether with operators, since in a system having a number of automatic stations there will be necessary some skilled inspectors to visit the stations in sequence; but the number of these men will be less than the number of operators now employed. At Cedar Rapids, Iowa, there is an installation of three 500 Kw. hydro-electric generators. That station is entirely automatic. It is operated, started and stopped when necessary either by distant control from another station or by the operation of the switch, which starts the station and when the proper level of water has been reached shuts it down until it reaches another level. That station is operated for as long as ten weeks at a time without any one going near it. We have a 3,000 Kw. synchronous condenser which is started and stopped automatically, operating in a station without any attendant. It starts when the voltage gets low enough so that it is needed, and stops when the demand is no longer needed.

Referring again to static condensers, Stone & Webster have install-

ed one of those at the Brocton-Stoughton sub-station of the Brocton-Edison Company. They have given in a pamphlet the results of that installation and the cost of four hundred KWA. capacity was $7,200.00; cost installed $7,500.00; then there is reduction in losses. Copies of those pamphlets are available at the General Electric Exhibit.

As the high tension systems are tied together and more power is available at any point the question of switching will have to be carefully considered, and we must have circuit-breakers of large rupturing capacity. These are now available, but there is some limit. It becomes necessary to install reactors to limit the power in some of the very large systems.

In connection with the automatic operation of stations it is desirable to introduce the automatic reclosing oil circuit-breakers. We have developed a relay which takes care of that feature and will reclose the circuit-breakers after it is opened two or three times at intervals of a few seconds, and then if trouble still exists it stays open until set by hand. If, however, after the first or second reclosing the short circuit has disappeared the relay drops back into its initial position and is ready for further trouble. That simulates pretty well the action of an operator, and can be applied to standard switches when motor operated. This will go a great way toward making the automatic sub-station take care of ordinary conditions.

Induction regulators may now be obtained for out-door operation. Regulators of all sizes, not only pole line regulators but regulators up to 1,000 Kw. are made for out-door operation; so that is another feature which helps automatic stations. By putting everything out of doors you do not have to build a house, you do not have to have an operator, and you save the heating of a house.

Gentlemen, I think that is all I have to say.

President-Elect Howell: All of us operators, both big and little, become more and more involved each year in the operation of transmission lines, and these transmission lines at least with the uninitiated seem to cut up capers. We often have to look for high frequencies and other things of a more technical nature, when the fault is a simple one. On the other hand, we sometimes find that the fault of the un-

successful operation of the line is really technical, is a highly involved subject when we are treating it as a simple one. I merely put this thought before you at this time to emphasize the fact that the successful operation of transmission lines certainly requires the most acute study of each individual system. Mr. Summerhayes has brought out a number of very good points in regard to the tendency of transmission line operation; I am sure that those concerned with the operation of transmission lines will profit most highly by a full discussion of this subject. We would like to hear from some of those present.

Mr. W. L. Wallau, Cleveland: Mr. Summerhayes spoke of the growing tendency to the use of the synchronous condenser in connection with transmission lines. I would like to call the attention of those present at this time to a paper that was presented before The American Institute of Electrical Engineers in 1913 or 1914, I forget which. The paper was by Mr. L. A. Phillips, and the exact title of it I do not remember, but it was along the general line of mechanics of transmission systems. In that paper Mr. Phillips I think for the first time brought out the idea of constant voltage transmission delivered from one point in the line by phase shift instead of by increased voltage. I think that many of us who are interested in the transmission problem might profit by reading that old paper in connection with what seems to be a new development but which really was well worked out several years ago. At the convention of the American Institute of Electrical Engineers, Mr. Silver presented a very interesting forecast in the nature of a paper entitled: "220 Kw. Transmission." Some of you have read the paper, and you will recall that there the circuits he deals with are transmitted over 150,000 Kw. circuits and he strongly insists on high tension switching. I think there are several reasons why it is perfectly clear that that should be done in such a case as that. In the first place, low tension switching with 1000,000 Kw. is a problem of considerable magnitude, and I do not know whether manufacturers are quite willing to say that they have a good low tension switch that will handle that; in other words, the volume of current is so large that it would be considerably simpler to have a switch that will handle a lower quantity of current and still be properly protected by proper bushings.

I should like to call attention of the members here to the various reports that were presented at Atlantic City by the technical committees of the N. E. L. A. There was a very interesting report on the cable situation by the National Transmission Committee, and some interesting features in the Apparatus Committee Report.

In regard to the porcelain for insulators, I understand that there is a company now which has what is to me a new development, a process whereby they anneal their porcelain insulators before final baking, which they claim takes out all the internal stresses. Mr. Summerhayes referred to the automatic sub-stations, and I feel that many of us are going to become considerably more interested in this particular application as the present labor tendencies do not seem to show any signs of abatement in their demand, and it becomes a question then as to when it will pay to install an automatic sub-station. Our company is looking into the matter somewhat with an idea that it may pay us. A rough way of checking it up I believe is to take the annual wage of the operators required as against the fixed charges for the additional equipment required to make the station automatic and the additional maintenance that may be required due to the fact that you have more apparatus. I do not care how good it is, some maintenance has to be done on it. I have not made any detailed calculation myself but I have formed somewhat of an idea in my own mind with reference to our own system.

President-Elect Howell: May we hear from some one else?

Prof. F. C. Caldwell, O. S. U., Columbus: Certainly an automatic sub-station is one of the fixed factors in increasing the economy of Central Station operation; and in this connection I would like to call your attention to the automatic re-closing circuit-breakers mentioned in the Report of the Committee. Those breakers are coming into considerable use in connection with automatic sub-stations. The characteristic of these breakers is that they will remain open on the predetermined load until the resistance in the line exceeds a certain predetermined amount which can be adjusted, and then the circuit- breakers will close. Upon again opening they stay open until the short circuit has been removed or until the resistance has risen to a certain

predetermined amount, and then they close again. Such breakers heretofore have had their greatest application in connection with coal mines, and an interesting use of such a breaker there comes to my mind. When the circuit-breakers are used in connection with different circuits as they are placed inside of the mine, when anything happens in a given part of the mine so that it is necessary to do work on the trolley line, the workman simply takes a crow-bar and lays it up against the trolley line. That opens the circuit-breaker, and they go ahead and do the work. When they get through they take the crow-bar off, and the current comes on again. (Laughter). Another device which this same company has just put on the market which is especially applicable to automatic sub-stations, but is not confined to those, is a device for indicating excessive temperature in the bearings. There are several of these on the market. This particular one operates on the thermometer principle. There is a solution of ether or something of that sort in a tube which is let down through a hole in the top of the bearings. The part of this tube containing this fluid rests on the shaft, and when the bearing goes up to too high a temperature the fluid expands and is forced up into a corrugated copper tube, and this tube expanding makes a substantial contact and lights a light or opens the switch. This device looks like it is going to be a very good thing. (Applause).

Mr. R. R. Krammes, Newark, Chairman: I would like to inquire when we should start to use an oil switch? Transmission people are interested to know where to begin and where to leave off?

Mr. H. R. Summerhayes, G. E. Co., Schenectady, N. Y.: I am sorry that I cannot give Mr. Krammes any detailed information on that. Our own designing engineers are still in doubt as to which air-brake switch will do best. There have been some cases where air-brake switches have opened on heavy loads; in other cases when the wind was blowing, or under very unfavorable conditions, they have failed to do so; and the capacity of air-brake switches is not yet determined sufficiently closely to make any definite statement as to that. We recommend them, however, for opening the magnetizing current for very large banks of transformers, and for that purpose they have

been found satisfactory. I understand that recently at the Windsor plant an air-brake switch was opened by mistake on a line that was carrying 10,000 Kw., 130,000 Volts, and operated successfully; but that may have been under favorable conditions.

Mr. R. R. Krammes, Newark, Chairman: Several manufacturers have developed an automatic air-brake switch, but I do not know of their being used on transmission lines. I have just brought this to the attention of the members present because it will probably be more or less used in different sub-stations if it works out in higher voltages. It has worked very satisfactorily on voltages up to 45,000; but the question is whether it is going to operate on higher voltages. The present tendency for transmission lines is toward longer transmission circuits and heavy loads. I do not know of any reason why it will not be the coming switch and no doubt considerably cheaper than the oil switch to take care of the same conditions.

President-Elect Howell: We would like to hear some further remarks on this proposition. We get the most benefit from a paper like this through its discussion.

Mr. Ivor L. Kentish-Rankin, Associate Editor Electrical Review, Chicago, Ill.: There are a good many sub-stations which are without attendants but which cannot be called automatic sub-stations. In these stations, of which thousands are found in the very large industrial plants throughout the country, a short circuit, a burnt out motor, or similar intermittent or sporadic trouble causes the circuit-breaker to open, with attendant loss of time. In such cases as these the re-closing type of circuit-breaker is very useful because it does not interrupt service longer than necessary. If the short circuit has removed itself, such as would be necessary when a man is required to reach the scene and close the circuit-breaker which is open, in such cases it is very often good policy to adopt some form of re-closing device without going to the high cost of investing in re-closing relays. The Southeastern Edison Company is using a number of special devices that they made themselves by which a circuit-breaker that has opened an overload may close again in one minute or so. This is accomplished

by means of a weight, a rope, a pulley, and some form of air valve. When the circuit-breaker opens a plunger drops as air escapes from the control mechanism. When this has functioned a latch liberates the weight which drops, and in dropping closes the circuit-breaker. The advantage of some such contrivance as this is that existing switches can very often be modified with little loss of time and very small expense. The more unlikely it is for a circuit-breaker to open, the more important it is to keep the investment to a minimum. The device just described accomplishes this.

President-Elect Howell: Is there further discussion of this question? If not, the Secretary has a matter to bring before us.

Secretary Gaskill: I have here the application for Associate Membership of the Electric Motor Repair Company of Akron, Ohio. The Executive Committee at its meeting yesterday recommended the election of this company as an Associate Member, and I move that they be so elected.

The motion was seconded by several members, carried by unanimous vote, and the concern named declared duly elected as an Associate Member.

CLOSING REMARKS BY PRESIDENT-ELECT HOWELL.

Gentlemen: As the convention comes to a close I feel like imposing upon your time for just one minute, in order to express to you my deep appreciation of the honor conferred by election to the position of leader of this live organization, The Ohio Electric Light Association. It is certainly a great consolation as an executive officer to know that one is at the head of a live organization. To me personally it seems an undeserved honor. However, I can best manifest that feeling by pledging to you now a one hundred per cent. effort during the coming year to advance the very best interests of the Association.

As I look back over the history of this Association and realize the tremendous success of the present convention, I do not feel brave enough to offer in any way a change of policy in the operation of this Association.

I trust that in the coming year you will assist the executive officers with your suggestions. Make them freely. They will be gladly received, I am sure. Let us work toward the end of making the 1920 year an even better year than was the Silver Anniversary Year.

If there are no other matters to bring before us at this time, I now declare the convention adjourned until the order of the Executive Committee.

The convention accordingly now adjourned without day.

INDEX

A

Page

Attendants at Convention 7

Acme Power Plant, description 45

B

Butt Welding 137

Banquet, annual 259

C

Columbus Railway Power and Lighting Co., New Station 42

Cole, R. D., address 195

D

Daily Unit Data and Cost System 54

Domestic Refrigeration, Paper on 99

Duct and Man-hole Ventilation 273

E

Electric Welders 129

Eagleston Under-Ground Record System 267

F

Finance Committee, Report of 260

H

Howell, C. H., Pres. Elect, Remarks 299

I

Industrial Electric Heating, Paper on 104

Industrial Heating 125

Illuminating Committee, Report of 211
Industrial Power, Sub-Stations 276

K

Kaighin, R. T., Paper on Industrial Heating 125

M

Mahoning & Shenango Railway & Electric Plant 46
McClellan, William, Address 153
Meter Committee, Report on 162
Meters Induction 173
McCabe, G. B., Remarks 284

N

Nominating Committee, Appointment of 27
New Business Co-operations Committee, Report 90
Nominating Committee, Report of 261

O

Officers for 1919-1920 3
Ohio Code of Industrial Lighting 92

P

Past Presidents 5
Places of Convention 6
President's Address 18

R

Power and Load Factors, Improvement of 112
Relation of Utility Company to Public Service Commissions 224

S

Resolutions Passed 263
Standing Committees 1919-1920 3
Secretary's Report 23

Station Operating Committee, Report of 34
Strike, J. M., Paper—Daily Unit Data 54
Stickney, George H., Address 221
Summerhayes, H. R., Remarks 286

T

Training Men for Meter Work 163
Transmission and Distribution Committee, Report on 267

U

Union Gas & Electric Company, Cincinnati 39

V

Voltage Regulation 277

W

War Experiences 195
White, L. G., Remarks 151

UNIVERSITY OF ILLINOIS-URBANA
3 0112 111811722